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(54) TONER, TWO-COMPONENT DEVELOPER, IMAGE FORMING METHOD AND DEVICE UNIT

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a toner with which an image excellent in image density stability and reproducibility of a precise part and no fog can be obtd. without causing deterioration in the toner even for long-term use.

SOLUTION: This toner contains toner particles and fine powder as an external additive. In the distribution of circularity and in the distribution of grain size calculated as equivalent diameters of corresponding circles measured by a flow-type particle image analyzer, the particles have 0.950 to 0.995 average circularity, the max. X in the region of 3.0 to 9.0 μm diameter calculated as circles and the max. Y in the region of 0.60 to 2.00 μm diameter of corresponding circles, and contains particles having $\geq 0.60 \mu\text{m}$ and $\leq 2.00 \mu\text{m}$ diameter of corresponding particles by 8.0 to 30.0% in number. The fine powder as an external additive contains an inorg. fine powder (A) having $\geq 1 \mu\text{m}$ and $< 30 \mu\text{m}$ number average major axial length of primary particles, and a nonspherical inorg. fine powder (B) having 30 to 600 μm number average major axial length and ≥ 150 shape factor SF-1 produced by aggregation of plural particles.

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CLAIMS

[Claim(s)]

[Claim 1] In a toner which has a toner particle containing binding resin and a coloring agent, and external additive impalpable powder at least this toner In circularity distribution of a particle measured by flow type particle image analysis apparatus, and particle size distribution by projected area diameter Have average circularity of 0.950 thru/or 0.995 and it has the maximal value X to a projected area diameter 3.0 thru/or a 9.0-micrometer field: Or it contains several- 30.0%. a projected area diameter 0.60 thru/or a 2.00-micrometer field — the maximal value Y — having — a 0.60-micrometer or more projected area diameter [less than 2.00 micrometer] particle — 8.0 — this external additive impalpable powder Shape factor SF-1 by which an individual number average major axis of a primary particle was generated on this toner particle when 1 or more mmum two or more non-subtlety powder (A) and particles of less than 30 mmum united is larger than 150. And a toner characterized by an individual number average major axis having 30 thru/or non-globular form-like non-subtlety powder (B) of 600mmum at least.

[Claim 2] This toner is a toner according to claim 1 characterized by having average circularity of 0.960 thru/or 0.995 in circularity distribution of a particle measured by flow type particle image analysis apparatus.

[Claim 3] This non-subtlety powder (A) is a toner according to claim 1 or 2 characterized by a primary particle having an individual number average major axis of 1mmum thru/or 25mmum on this toner particle.

[Claim 4] This non-subtlety powder (A) is a toner according to claim 1 to 3 characterized by a primary particle having a ratio (a major axis/minor axis) of a major axis of 1.0 thru/or 1.5, and a minor axis on this toner particle.

[Claim 5] Non-globular form-like non-subtlety powder (B) is a toner according to claim 1 to 4 characterized by having an individual number average major axis of 30mmum thru/or 300mmum on this toner particle.

[Claim 6] On this toner particle, this non-globular form-like non-subtlety powder (B) is a toner according to claim 1 to 5 generated when two or more primary particles which have the average of the diameter of fillet minimum width of face of 30mmum thru/or 200mmum unite.

[Claim 7] This non-subtlety powder (A) is a toner according to claim 1 to 6 characterized by having specific surface area by nitrogen adsorption with a BET adsorption method of 50 thru/or 150m² / g.

[Claim 8] This non-globular form-like non-subtlety powder (B) is a toner according to claim 1 to 7 characterized by having specific surface area by nitrogen adsorption with a BET adsorption method of 20 thru/or 90m² / g.

[Claim 9] This non-subtlety powder (A) is a toner according to claim 1 to 8 characterized by having shape factor SF-1 of 100 thru/or 125 on this toner particle.

[Claim 10] This non-globular form-like non-subtlety powder (B) is a toner according to claim 1 to 9 characterized by having shape factor SF-1 [larger] than 190 on this toner particle.

[Claim 11] This non-globular form-like non-subtlety powder (B) is a toner according to claim 1 to 9 characterized by having shape factor SF-1 [larger] than 200 on this toner particle.

[Claim 12] On this toner particle, a primary particle exists in independent or the condition of

having condensed, and sets this non-subtlety powder (A) to an electron microscope enlargement of this toner. Independent or the sum total of a primary particle of this non-subtlety powder (A) which exists in the condition of having condensed on an average per

0.5micrometerx0.5micrometer area 20 or more pieces, And a toner according to claim 1 characterized by non-globular form-like non-subtlety powder (B) existing on the surface of 1 thru/or 20 pieces, and this toner particle on an average per 1.0micrometerx1.0micrometer area.

[Claim 13] On this toner particle, a primary particle exists in independent or the condition of having condensed, and sets this non-subtlety powder (A) to an electron microscope enlargement of this toner. Independent or the sum total of a primary particle of this non-subtlety powder (A) which exists in the condition of having condensed on an average per

0.5micrometerx0.5micrometer area 25 or more pieces, And a toner according to claim 1 characterized by non-globular form-like non-subtlety powder (B) existing on the surface of 2 thru/or 18 pieces, and this toner particle on an average per 1.0micrometerx1.0micrometer area.

[Claim 14] This toner is a toner according to claim 1 to 13 characterized for this non-subtlety powder (A) by 0.1 thru/or carrying out 3.0 weight **** into this toner 100 weight section.

[Claim 15] This toner is a toner according to claim 1 to 14 characterized for this non-globular form-like non-subtlety powder (B) by 0.1 thru/or carrying out 3.0 weight **** into this toner 100 weight section.

[Claim 16] This non-subtlety powder (A) and this non-globular form-like non-subtlety powder (B) are a toner according to claim 1 to 15 characterized by having a particle chosen from a group who consists of a silica, an alumina, titanias, and those suboxides.

[Claim 17] This non-subtlety powder (A) and this non-globular form-like non-subtlety powder (B) are a toner according to claim 1 to 15 characterized by having a silica particle.

[Claim 18] This non-subtlety powder (A) and this non-globular form-like non-subtlety powder (B) are a toner according to claim 1 to 17 characterized by having silicone oil.

[Claim 19] a polymerization nature monomer constituent with which this toner particle contains a polymerization nature monomer and a coloring agent at least — the bottom of existence of a polymerization initiator — a solvent — a toner according to claim 1 to 18 characterized by being manufactured by polymerization method which carries out a polymerization in a body.

[Claim 20] This toner particle is a toner according to claim 1 to 18 characterized by being manufactured by polymerization method which carries out the suspension polymerization of the polymerization nature monomer constituent which contains a polymerization nature monomer and a coloring agent at least in basin system data medium under existence of a polymerization initiator.

[Claim 21] This toner is a toner according to claim 1 to 20 characterized by being a nonmagnetic toner.

[Claim 22] This toner is a toner according to claim 1 to 20 characterized by being used as an one component system developer.

[Claim 23] It is the toner according to claim 1 to 20 characterized by for this toner being a nonmagnetic toner and using this nonmagnetic toner as a nonmagnetic one component system developer.

[Claim 24] In a binary system developer which has a toner which has a toner particle and external additive impalpable powder which contain binding resin and a coloring agent at least, and a carrier this toner In circularity distribution of a particle measured by flow type particle image analysis apparatus, and particle size distribution by projected area diameter Have average circularity of 0.950 thru/or 0.995 and it has the maximal value X to a projected area diameter 3.0 thru/or a 9.0-micrometer field. Or it contains several 30.0%. a projected area diameter 0.60 thru/or a 2.00-micrometer field — the maximal value Y — having — a 0.60-micrometer or more projected area diameter [less than 2.00 micrometer] particle — 8.0 — this external additive impalpable powder Shape factor SF-1 by which an individual number average major axis of a primary particle was generated on this toner particle when 1 or more mmum two or more non-subtlety powder (A) and particles of less than 30 mmum united is larger than 150. And a binary system developer characterized by an individual number average major axis having 30 thru/or non-globular form-like non-subtlety powder (B) of 600mmum at least.

[Claim 25] This toner is a binary system developer according to claim 24 characterized by having average circularity of 0.960 thru/or 0.995 in circularity distribution of a particle measured by flow type particle image analysis apparatus.

[Claim 26] This non-subtlety powder (A) is a binary system developer according to claim 24 or 25 characterized by a primary particle having an individual number average major axis of 1mmum thru/or 25mmum on this toner particle.

[Claim 27] This non-subtlety powder (A) is a binary system developer according to claim 24 to 26 characterized by a primary particle having a ratio (a major axis/minor axis) of a major axis of 1.0 thru/or 1.5, and a minor axis on this toner particle.

[Claim 28] Non-globular form-like non-subtlety powder (B) is a binary system developer according to claim 24 to 27 characterized by having an individual number average major axis of 30mmum thru/or 300mmum on this toner particle.

[Claim 29] On this toner particle, this non-globular form-like non-subtlety powder (B) is a binary system developer according to claim 24 to 28 generated when two or more primary particles which have the average of the diameter of fillet minimum width of face of 30mmum thru/or 200mmum unite.

[Claim 30] This non-subtlety powder (A) is a binary system developer according to claim 24 to 29 characterized by having specific surface area by nitrogen adsorption with a BET adsorption method of 50 thru/or 150m² / g.

[Claim 31] This non-globular form-like non-subtlety powder (B) is a binary system developer according to claim 24 to 30 characterized by having specific surface area by nitrogen adsorption with a BET adsorption method of 20 thru/or 90m² / g.

[Claim 32] This non-subtlety powder (A) is a binary system developer according to claim 24 to 31 characterized by having shape factor SF-1 of 100 thru/or 125 on this toner particle.

[Claim 33] This non-globular form-like non-subtlety powder (B) is a binary system developer according to claim 24 to 32 characterized by having shape factor SF-1 [larger] than 190 on this toner particle.

[Claim 34] This non-globular form-like non-subtlety powder (B) is a binary system developer according to claim 24 to 32 characterized by having shape factor SF-1 [larger] than 200 on this toner particle.

[Claim 35] On this toner particle, a primary particle exists in independent or the condition of having condensed, and sets this non-subtlety powder (A) to an electron microscope enlargement of this toner. Independent or the sum total of a primary particle of this non-subtlety powder (A) which exists in the condition of having condensed on an average per 0.5micrometerx0.5micrometer area 20 or more pieces, And a binary system developer according to claim 24 characterized by non-globular form-like non-subtlety powder (B) existing on the surface of 1 thru/or 20 pieces, and this toner particle on an average per 1.0micrometerx1.0micrometer area.

[Claim 36] On this toner particle, a primary particle exists in independent or the condition of having condensed, and sets this non-subtlety powder (A) to an electron microscope enlargement of this toner. Independent or the sum total of a primary particle of this non-subtlety powder (A) which exists in the condition of having condensed on an average per 0.5micrometerx0.5micrometer area 25 or more pieces, And a binary system developer according to claim 24 characterized by non-globular form-like non-subtlety powder (B) existing per 1.0micrometerx1.0micrometer area on the surface of an average of 2 thru/or 18 pieces, and this toner particle.

[Claim 37] This toner is a binary system developer according to claim 24 to 36 characterized for this non-subtlety powder (A) by 0.1 thru/or carrying out 3.0 weight **** into this toner 100 weight section.

[Claim 38] This toner is a binary system developer according to claim 24 to 37 characterized for this non-globular form-like non-subtlety powder (B) by 0.1 thru/or carrying out 3.0 weight **** into this toner 100 weight section.

[Claim 39] This non-subtlety powder (A) and this non-globular form-like non-subtlety powder (B) are a binary system developer according to claim 24 to 38 characterized by having a particle

chosen from a group who consists of a silica, an alumina, titanias, and those suboxides.

[Claim 40] This non-subtlety powder (A) and this non-globular form-like non-subtlety powder (B) are a binary system developer according to claim 24 to 38 characterized by having a silica particle.

[Claim 41] This non-subtlety powder (A) and this non-globular form-like non-subtlety powder (B) are a binary system developer according to claim 24 to 40 characterized by having silicone oil.

[Claim 42] a polymerization nature monomer constituent with which this toner particle contains a polymerization nature monomer and a coloring agent at least — the bottom of existence of a polymerization initiator — a solvent — a binary system developer according to claim 24 to 41 characterized by being manufactured by polymerization method which carries out a polymerization in a body.

[Claim 43] This toner particle is a binary system developer according to claim 24 to 42 characterized by being manufactured by polymerization method which carries out the suspension polymerization of the polymerization nature monomer constituent which contains a polymerization nature monomer and a coloring agent at least in basin system data medium under existence of a polymerization initiator.

[Claim 44] This toner is a toner according to claim 24 to 41 characterized by being a nonmagnetic toner.

[Claim 45] (I) — with a toner an electrostatic latent image of latent-image formation production process; (III) this latent-image support which forms an electrostatic latent image in latent-image support by which electrification production process; (II) electrification charged in latent-image support for supporting an electrostatic latent image was carried out In an image formation method of having imprint production process; which imprints a toner image formed on development production process; which develops negatives and forms a toner image, and (IV) this latent-image support to imprint material this toner It has a toner particle and external additive impalpable powder which contain binding resin and a coloring agent at least. This toner In circularity distribution of a particle measured by flow type particle image analysis apparatus, and particle size distribution by projected area diameter Have average circularity of 0.950 thru/or 0.995 and it has the maximal value X to a projected area diameter 3.0 thru/or a 9.0-micrometer field. Or it contains several 30.0% a projected area diameter 0.6 thru/or a 2.00-micrometer field — the maximal value Y — having — a 0.60-micrometer or more projected area diameter [less than 2.00 micrometer] particle — 8.0 — this external additive impalpable powder Shape factor SF-1 by which an individual number average major axis of a primary particle was generated on this toner particle when 1 or more mmum two or more non-subtlety powder (A) and particles of less than 30 mmum united is larger than 150. And an image formation method characterized by an individual number average major axis having 30 thru/or non-globular form inorganic impalpable powder (B) of 600mmum at least.

[Claim 46] This toner is the image formation method according to claim 45 characterized by having average circularity of 0.960 thru/or 0.995 in circularity distribution of a particle measured by flow type particle image analysis apparatus.

[Claim 47] This non-subtlety powder (A) is the image formation method according to claim 45 or 46 characterized by a primary particle having an individual number average major axis of 1mmum thru/or 25mmum on this toner particle.

[Claim 48] This non-subtlety powder (A) is the image formation method according to claim 45 to 47 characterized by a primary particle having a ratio (a major axis/minor axis) of a major axis of 1.0 thru/or 1.5, and a minor axis on this toner particle.

[Claim 49] Non-globular form-like non-subtlety powder (B) is the image formation method according to claim 45 to 48 characterized by having an individual number average major axis of 30mmum thru/or 300mmum on this toner particle.

[Claim 50] On this toner particle, this non-globular form-like non-subtlety powder (B) is the image formation method according to claim 45 to 49 generated when two or more primary particles which have the average of the diameter of fillet minimum width of face of 30mmum thru/or 200mmum unite.

[Claim 51] This non-subtlety powder (A) is the image formation method according to claim 45 to 50 characterized by having specific surface area by nitrogen adsorption with a BET adsorption method of 50 thru/or 150m² / g.

[Claim 52] This non-globular form-like non-subtlety powder (B) is the image formation method according to claim 45 to 51 characterized by having specific surface area by nitrogen adsorption with a BET adsorption method of 20 thru/or 90m² / g.

[Claim 53] This non-subtlety powder (A) is the image formation method according to claim 45 to 52 characterized by having shape factor SF-1 of 100 thru/or 125 on this toner particle.

[Claim 54] This non-globular form-like non-subtlety powder (B) is the image formation method according to claim 45 to 53 characterized by having shape factor SF-1 [larger] than 190 on this toner particle.

[Claim 55] This non-globular form-like non-subtlety powder (B) is the image formation method according to claim 45 to 53 characterized by having shape factor SF-1 [larger] than 200 on this toner particle.

[Claim 56] On this toner particle, a primary particle exists in independent or the condition of having condensed, and sets this non-subtlety powder (A) to an electron microscope enlargement of this toner. Independent or the sum total of a primary particle of this non-subtlety powder (A) which exists in the condition of having condensed on an average per 0.5micrometerx0.5micrometer area 20 or more pieces, And an image formation method according to claim 45 characterized by non-globular form-like non-subtlety powder (B) existing on the surface of 1 thru/or 20 pieces, and this toner particle on an average per 1.0micrometerx1.0micrometer area.

[Claim 57] On this toner particle, a primary particle exists in independent or the condition of having condensed, and sets this non-subtlety powder (A) to an electron microscope enlargement of this toner. Independent or the sum total of a primary particle of this non-subtlety powder (A) which exists in the condition of having condensed on an average per 0.5micrometerx0.5micrometer area 25 or more pieces, And an image formation method according to claim 45 characterized by non-globular form-like non-subtlety powder (B) existing on the surface of 2 thru/or 18 pieces, and this toner particle on an average per 1.0micrometerx1.0micrometer area.

[Claim 58] This toner is the image formation method according to claim 45 to 57 characterized for this non-subtlety powder (A) by 0.1 thru/or carrying out 3.0 weight **** into this toner 100 weight section.

[Claim 59] This toner is the image formation method according to claim 45 to 58 characterized for this non-globular form-like non-subtlety powder (B) by 0.1 thru/or carrying out 3.0 weight **** into this toner 100 weight section.

[Claim 60] This non-subtlety powder (A) and this non-globular form-like non-subtlety powder (B) are the image formation method according to claim 45 to 59 characterized by having a particle chosen from a group who consists of a silica, an alumina, titanias, and those suboxides.

[Claim 61] This non-subtlety powder (A) and this non-globular form-like non-subtlety powder (B) are the image formation method according to claim 45 to 59 characterized by having a silica particle.

[Claim 62] This non-subtlety powder (A) and this non-globular form-like non-subtlety powder (B) are the image formation method according to claim 45 to 61 characterized by having silicone oil.

[Claim 63] a polymerization nature monomer constituent with which this toner particle contains a polymerization nature monomer and a coloring agent at least — the bottom of existence of a polymerization initiator — a solvent — an image formation method according to claim 45 to 62 characterized by being manufactured by polymerization method which carries out a polymerization in a body.

[Claim 64] This toner particle is the image formation method according to claim 45 to 62 characterized by being manufactured by polymerization method which carries out the suspension polymerization of the polymerization nature monomer constituent which contains a polymerization nature monomer and a coloring agent at least in basin system data medium under

existence of a polymerization initiator.

[Claim 65] This toner is the image formation method according to claim 45 to 46 characterized by being a nonmagnetic toner.

[Claim 66] This toner is the image formation method according to claim 45 to 64 characterized by being used as an one component system developer.

[Claim 67] It is the image formation method according to claim 45 to 64 which this toner is a nonmagnetic toner and is characterized by using this nonmagnetic toner as a nonmagnetic one component system developer.

[Claim 68] It is the image formation method according to claim 45 to 64 which this toner is a nonmagnetic toner and is characterized by mixing with a carrier and using this nonmagnetic toner as a binary system developer.

[Claim 69] A toner image which a toner image which this imprint material is record material and is formed on this latent-image support was directly imprinted by this record material, and was imprinted on this record material is the image formation method according to claim 45 to 68 characterized by establishing this record material.

[Claim 70] A toner image which this imprint material is a middle imprint object, and is formed on this latent-image support A toner image which a toner image which was primarily imprinted by this middle imprint object and was primarily imprinted on this middle imprint object was secondarily imprinted by record material, and was secondarily imprinted on this record material is the image formation method according to claim 45 to 68 characterized by establishing this record material.

[Claim 71] This image formation method is an electrification production process charged in latent-image support for supporting (i) electrostatic latent image;

(ii) A latent-image formation production process which forms an electrostatic latent image in electrified latent-image support;

(iii) An imprint production process which imprints a color toner image formed on development production process; which develops an electrostatic latent image of this latent-image support with a color toner chosen from a group who consists of a cyanogen toner, a Magenta toner, and a yellow toner, and forms a color toner image, and (iv) this latent-image support to imprint material;

Are ****(ing) and a production process of the above (i) thru/or (iv) is repeated using a color toner of other colors one by one twice or more. It is the color picture formation method which forms a multicolor color toner image on this imprint material. This cyanogen toner It has a cyanogen toner particle and this external additive impalpable powder which contain binding resin and a cyanogen coloring agent at least. This Magenta toner It has a Magenta toner particle and this external additive impalpable powder which contain binding resin and a Magenta coloring agent at least. This yellow toner An image formation method according to claim 45 to 70 characterized by having a yellow toner particle and this external additive impalpable powder which contain binding resin and a yellow coloring agent at least.

[Claim 72] In addition to this cyanogen toner, this Magenta toner, and this yellow toner, a toner of four colors of a black toner is used. A production process of the above (i) thru/or (iv) is repeated using a toner of other colors one by one 4 times. It is the image formation method according to claim 71 characterized by being the full color image formation method which forms a color toner image of four colors on this imprint material, and this black toner having a black toner particle and this external additive impalpable powder which contain binding resin and a black coloring agent at least.

[Claim 73] This image formation method is the image formation method according to claim 45 to 72 characterized by having further a cleaning production process for collecting toners which remain on the surface of this latent-image support after an imprint production process.

[Claim 74] This cleaning production process is the image formation method according to claim 73 characterized by using a cleaning method before development to which cleaning of this latent-image support surface is performed by cleaning member which is after an imprint production process and contacts on this latent-image support surface before a development production process.

[Claim 75] It is the image formation method according to claim 74 which this cleaning production process is after an imprint production process in this cleaning method before development, and is characterized by being carried out before an electrification production process.

[Claim 76] The imprint section in this imprint production process, a live part in this electrification production process, and the development section in this development production process It is arranged along the migration direction of this latent-image support in order of this imprint section, this live part, and this development section. Between this imprint section and this live part and between this live part and this development section A cleaning member for collecting toners with which all remain on this latent-image support surface in contact with this latent-image support surface does not exist. This cleaning production process While developing an electrostatic latent image with which a developer which holds this toner at the time of a development production process is supported by this latent-image support with this toner An image formation method according to claim 73 characterized by using a development coincidence cleaning method with which cleaning of this latent-image support surface is performed when this developer collects toners which remain on this latent-image support surface.

[Claim 77] In an equipment unit with which a main part of image formation equipment is equipped removable this equipment unit A toner as an one component system developer which has a toner particle containing binding resin and a coloring agent, and external additive impalpable powder at least; An one component system developer held in development container [for holding this one component system developer]; and this development container is supported. It has developer support for conveying to a development field. And this toner In circularity distribution of a particle measured by flow type particle image analysis apparatus, and particle size distribution by projected area diameter Have average circularity of 0.950 thru/or 0.995 and it has the maximal value X to a projected area diameter 3.0 thru/or a 9.0-micrometer field. Or it contains several 30.0%, a projected area diameter 0.60 thru/or a 2.00-micrometer field — the maximal value Y — having — a 0.60-micrometer or more projected area diameter [less than 2.00 micrometer] particle — 8.0 — this external additive impalpable powder Shape factor SF-1 by which an individual number average major axis of a primary particle was generated on this toner particle when 1 or more mmum two or more non-subtlety powder (A) and particles of less than 30 mmum united is larger than 150. And an equipment unit characterized by an individual number average major axis having 30 thru/or non-globular form-like non-subtlety powder (B) of 600mmum at least.

[Claim 78] This toner is an equipment unit according to claim 77 characterized by having average circularity of 0.960 thru/or 0.995 in circularity distribution of a particle measured by flow type particle image analysis apparatus.

[Claim 79] This non-subtlety powder (A) is an equipment unit according to claim 77 or 78 characterized by a primary particle having an individual number average major axis of 1mmum thru/or 25mmum on this toner particle.

[Claim 80] This non-subtlety powder (A) is an equipment unit according to claim 77 to 79 characterized by a primary particle having a ratio (a major axis/minor axis) of a major axis of 1.0 thru/or 1.5, and a minor axis on this toner particle.

[Claim 81] Non-globular form-like non-subtlety powder (B) is an equipment unit according to claim 77 to 80 characterized by having an individual number average major axis of 30mmum thru/or 300mmum on this toner particle.

[Claim 82] On this toner particle, this non-globular form-like non-subtlety powder (B) is an equipment unit according to claim 77 to 81 generated when two or more primary particles which have the average of the diameter of fillet minimum width of face of 30mmum thru/or 200mmum unite.

[Claim 83] This non-subtlety powder (A) is an equipment unit according to claim 77 to 82 characterized by having specific surface area by nitrogen adsorption with a BET adsorption method of 50 thru/or 150m² / g.

[Claim 84] This non-globular form-like non-subtlety powder (B) is an equipment unit according to claim 77 to 83 characterized by having specific surface area by nitrogen adsorption with a BET adsorption method of 20 thru/or 90m² / g.

[Claim 85] This non-subtlety powder (A) is an equipment unit according to claim 77 to 84 characterized by having shape factor SF-1 of 100 thru/or 125 on this toner particle.

[Claim 86] This non-globular form-like non-subtlety powder (B) is an equipment unit according to claim 77 to 85 characterized by having shape factor SF-1 [larger] than 190 on this toner particle.

[Claim 87] This non-globular form-like non-subtlety powder (B) is an equipment unit according to claim 77 to 85 characterized by having shape factor SF-1 [larger] than 200 on this toner particle.

[Claim 88] On this toner particle, a primary particle exists in independent or the condition of having condensed, and sets this non-subtlety powder (A) to an electron microscope enlargement of this toner. Independent or the sum total of a primary particle of this non-subtlety powder (A) which exists in the condition of having condensed on an average per

0.5micrometerx0.5micrometer area 20 or more pieces, And an equipment unit according to claim 77 characterized by non-globular form-like non-subtlety powder (B) existing on the surface of 1 thru/or 20 pieces, and this toner particle on an average per 1.0micrometerx1.0micrometer area.

[Claim 89] On this toner particle, a primary particle exists in independent or the condition of having condensed, and sets this non-subtlety powder (A) to an electron microscope enlargement of this toner. Independent or the sum total of a primary particle of this non-subtlety powder (A) which exists in the condition of having condensed on an average per

0.5micrometerx0.5micrometer area 25 or more pieces, And an equipment unit according to claim 77 characterized by non-globular form-like non-subtlety powder (B) existing per 1.0micrometerx1.0micrometer area on the surface of an average of 2 thru/or 18 pieces, and this toner particle.

[Claim 90] This toner is a toner according to claim 77 to 89 characterized for this non-subtlety powder (A) by 0.1 thru/or carrying out 3.0 weight **** into this toner 100 weight section.

[Claim 91] This toner is an equipment unit according to claim 77 to 90 characterized for this non-globular form-like non-subtlety powder (B) by 0.1 thru/or carrying out 3.0 weight **** into this toner 100 weight section.

[Claim 92] This non-subtlety powder (A) and this non-globular form-like non-subtlety powder (B) are an equipment unit according to claim 77 to 91 characterized by having a particle chosen from a group who consists of a silica, an alumina, titanias, and those suboxides.

[Claim 93] This non-subtlety powder (A) and this non-globular form-like non-subtlety powder (B) are an equipment unit according to claim 77 to 91 characterized by having a silica particle.

[Claim 94] This non-subtlety powder (A) and this non-globular form-like non-subtlety powder (B) are an equipment unit according to claim 77 to 93 characterized by having silicone oil.

[Claim 95] a polymerization nature monomer constituent with which this toner particle contains a polymerization nature monomer and a coloring agent at least — the bottom of existence of a polymerization initiator — a solvent — an equipment unit according to claim 77 to 94 characterized by being manufactured by polymerization method which carries out a polymerization in a body.

[Claim 96] This toner particle is an equipment unit according to claim 77 to 94 characterized by being manufactured by polymerization method which carries out the suspension polymerization of the polymerization nature monomer constituent which contains a polymerization nature monomer and a coloring agent at least in basin system data medium under existence of a polymerization initiator.

[Claim 97] This toner is an equipment unit according to claim 77 to 96 characterized by being a nonmagnetic toner.

[Claim 98] This equipment unit is an equipment unit according to claim 77 to 97 by which it is having-further-member more than kind chosen from group who consists of cleaning member for cleaning live-part material [for latent-image support for supporting an electrostatic latent image and this latent-image support being charged primarily in addition to this one component system developer, this development container, and this developer support], and the surface of this latent-image support characterized.

[Claim 99] This equipment unit is an equipment unit according to claim 77 to 97 characterized by

having a photo conductor for electrophotography further as latent-image support for supporting an electrostatic latent image in addition to this one component system developer, this development container, and this development support.

[Translation done.]

* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the toner used for the record method using a xerography, an electrostatic recording method, magnetic recording, or the toner jet method recording method. In detail, this invention relates to the binary system developer, the image formation method, and equipment unit using the toner for electrostatic-charge image development and this toner which are used for the copying machine and printer which are made to imprint on imprint material and carry out image formation, and the image formation equipment like facsimile after forming a toner image on electrostatic latent-image support beforehand.

[0002]

[Description of the Prior Art] After forming an electrostatic latent image in photo conductor drum lifting according to exposure optical system and carrying out toner development of this electrostatic latent image with a developer from the former, the image formation equipment which imprints and fixes said toner image to the recording paper is known.

[0003] There are an one component system developer and a binary system developer as developer used for development with the above-mentioned developer. By friction with toner particles or suitable live-part material, a toner particle is charged and an one component system developer is carried by the development sleeve of a developer, on a photo conductor side, adheres to the latent-image section and forms a toner image.

[0004] By the way, when the fluidity of a developer fell by putting a development counter for a long period of time in formation of said toner image, since it set especially to an one component system developer and the adhesion force between the particles of a toner became strong, although electrification of a toner particle was not performed to satisfaction but the latent-image image was uniform as a result, the phenomenon in which a visible image becomes an ununiformity, and the so-called "nonuniformity" might come out, and "graze" might arise. As a method of preventing this, a developer is beforehand agitated within a developer and the method of giving a fluidity is widely used from the former.

[0005] However, too much churning of a developer promoted toner deterioration, and had become the factor to which a developer life becomes short.

[0006] A binary system developer is mixed with a mixing ratio with moderate magnetic carrier particle and toner particle made of nonmagnetic synthetic resin, and by mixing with a carrier particle, a toner particle is charged, is carried by the development sleeve of a developer, adheres to the latent-image section on the photo conductor surface, and forms a toner image. As the development method using such a binary system developer With for example, the binary system developer which becomes JP,55-32060,A and JP,59-165082,A from a carrier particle and a toner particle A magnetic brush is made to form in the surface of the development sleeve which has arranged the magnet inside. By impressing mutual electric field continuously between a development sleeve and a photoconductor drum (between S-D) by making this magnetic brush **** or approach the photoconductor drum which held the very small development gap and it was made to counter The so-called magnetic brush developing-negatives method for developing

negatives by making at least the rearrangement from the development sleeve side of a toner particle to a photoconductor drum side and an inversion perform repeatedly is indicated.

[0007] In the magnetic brush developing—negatives method using such a binary system developer, although, as for a toner particle, a frictional electrification charge is given by mixing with a carrier particle, a carrier particle is in the orientation which toner deterioration promotes, when a toner particle will receive high mechanical stress and therefore performs repeat development actuation by **** with a carrier particle at the time of mixing, since specific gravity is high compared with a toner particle.

[0008] When the toner deterioration mentioned above arises, the phenomenon; to which the minute repeatability of, image which so-called “fogging” in which a part of toner particle specifically adheres to the; non-image section from which the concentration of a fixing image changes by use over a long period of time produces gets worse happens.

[0009] this invention persons showed clearly that the following three phenomena are related to the above—mentioned toner deterioration wholeheartedly as a result of examination.

[0010] The first phenomenon is failure of a toner particle, and atomization.

[0011] When the toner with which each particle shape represented by the grinding method toner generally used is toothing, and configurations differ separately was agitated within a developer over a long period of time, by the collision of a toner particle, developer support, or toner particles, especially the heights were damaged and the toner particle and atomizing became clear.

[0012] The second development is flasking on the toner particle surface of an external additive particle.

[0013] Although the particle used as an external additive particle in the heights on the surface of a toner was buried in the toner particle surface when the toner with which each particle shape like the grinding method toner is irregularity, and configurations differ separately was used, flasking of an external additive was not accepted in the crevice. Although failure of a toner particle and atomization were not accepted on the other hand when the toner particle with spherical particle shape represented by for example, the polymerization method toner was used, it became clear that the particle added as an external additive is buried in the toner particle surface at homogeneity.

[0014] The electrification property of a toner particle did not equalize the third phenomenon.

[0015] When the electrification distribution was measured using the conventionally well-known general toner particle and a toner particle was agitated within a developer over a long period of time, it became clear that electrification distribution spreads compared with churning before.

[0016]

[Problem(s) to be Solved by the Invention] This invention aims at solving the above—mentioned trouble.

[0017] Without toner deterioration arising also in the use over a long period of time, this invention is excellent in image concentration stability and details section repeatability, and aims at offering the binary system developer, the image formation method, and equipment unit using the toner and this toner with which the image which fogging does not produce is obtained.

[0018]

[Means for Solving the Problem] A configuration of the following this inventions can attain the above—mentioned purpose.

[0019] In a toner which has at least a toner particle to which this invention contains binding resin and a coloring agent, and external additive impalpable powder this toner In circularity distribution of a particle measured by flow type particle image analysis apparatus, and particle size distribution by projected area diameter Have average circularity of 0.950 thru/or 0.995 and it has the maximal value X to a projected area diameter 3.0 thru/or a 9.0—micrometer field. Or it contains several 30.0%. a projected area diameter 0.60 thru/or a 2.00—micrometer field — the maximal value Y — having — a 0.60—micrometer or more projected area diameter [less than 2.00 micrometer] particle — 8.0 — this external additive impalpable powder Shape factor SF—1 by which an individual number average major axis of a primary particle was generated on this toner particle when 1 or more mmum two or more non—subtlety powder (A) and particles of less

than 30 mmum united is larger than 150. And an individual number average major axis is related with a toner characterized by having 30 thru/or non-globular form-like non-subtlety powder (B) of 600mmum at least.

[0020] In a binary system developer which has a toner which has a toner particle and external additive impalpable powder with which this invention contains binding resin and a coloring agent at least, and a carrier this toner In circularity distribution of a particle measured by flow type particle image analysis apparatus, and particle size distribution by projected area diameter Have average circularity of 0.950 thru/or 0.995 and it has the maximal value X to a projected area diameter 3.0 thru/or a 9.0-micrometer field. Or it contains several 30.0%. a projected area diameter 0.60 thru/or a 2.00-micrometer field — the maximal value Y — having — a 0.60-micrometer or more projected area diameter [less than 2.00 micrometer] particle — 8.0 — this external additive impalpable powder Shape factor SF-1 by which an individual number average major axis of a primary particle was generated on this toner particle when 1 or more mmum two or more non-subtlety powder (A) and particles of less than 30 mmum united is larger than 150. And an individual number average major axis is related with a binary system developer characterized by having 30 thru/or non-globular form-like non-subtlety powder (B) of 600mmum at least.

[0021] This invention (I) — with a toner an electrostatic latent image of latent-image formation production process; (III) this latent-image support which forms an electrostatic latent image in latent-image support by which electrification production process; (II) electrification charged in latent-image support for supporting an electrostatic latent image was carried out In an image formation method of having imprint production process; which imprints a toner image formed on development production process; which develops negatives and forms a toner image, and (IV) this latent-image support to imprint material this toner It has a toner particle and external additive impalpable powder which contain binding resin and a coloring agent at least. This toner In circularity distribution of a particle measured by flow type particle image analysis apparatus, and particle size distribution by projected area diameter Have average circularity of 0.950 thru/or 0.995 and it has the maximal value X to a projected area diameter 3.0 thru/or a 9.0-micrometer field. Or it contains several 30.0%. a projected area diameter 0.6 thru/or a 2.00-micrometer field — the maximal value Y — having — a 0.60-micrometer or more projected area diameter [less than 2.00 micrometer] particle — 8.0 — this external additive impalpable powder Shape factor SF-1 by which an individual number average major axis of a primary particle was generated on this toner particle when 1 or more mmum two or more non-subtlety powder (A) and particles of less than 30 mmum united is larger than 150. And an individual number average major axis is related with an image formation method characterized by having 30 thru/or non-globular form inorganic impalpable powder (B) of 600mmum at least.

[0022] In an equipment unit by which a main part of image formation equipment is equipped with this invention removable this equipment unit A toner as an one component system developer which has a toner particle containing binding resin and a coloring agent, and external additive impalpable powder at least; An one component system developer held in development container [for holding this one component system developer]; and this development container is supported. It has developer support for conveying to a development field. And this toner In circularity distribution of a particle measured by flow type particle image analysis apparatus, and particle size distribution by projected area diameter Have average circularity of 0.950 thru/or 0.995 and it has the maximal value X to a projected area diameter 3.0 thru/or a 9.0-micrometer field. Or it contains several 30.0%. a projected area diameter 0.60 thru/or a 2.00-micrometer field — the maximal value Y — having — a 0.60-micrometer or more projected area diameter [less than 2.00 micrometer] particle — 8.0 — this external additive impalpable powder Shape factor SF-1 by which an individual number average major axis of a primary particle was generated on this toner particle when 1 or more mmum two or more non-subtlety powder (A) and particles of less than 30 mmum united is larger than 150. And an individual number average major axis is related with an equipment unit characterized by having 30 thru/or non-globular form-like non-subtlety powder (B) of 600mmum at least.

[0023]

[Embodiment of the Invention] Without toner deterioration arising also in the use over a long period of time by using at least two sorts of impalpable powder which has a specific configuration and a specific specific individual number average major axis as external additive impalpable powder used for the toner which has specific circularity distribution and the specific particle size distribution by the projected area diameter as a result of this invention persons' inquiring wholeheartedly, it excelled in image concentration stability and minute section repeatability, and found out that the image which fogging does not produce was obtained.

[0024] Although the details are unknown about the reason the above-mentioned effect is acquired, it guesses as follows.

[0025] this invention persons showed clearly that the following three phenomena are related to developer deterioration wholeheartedly as a result of examination.

[0026] The first phenomenon is heights failure and atomization of a toner particle. The second phenomenon is flaking on the toner particle surface of an external additive. The electrification property of a toner particle did not equalize the third phenomenon.

[0027] It results in this invention based on many above-mentioned phenomena.

[0028] The gestalt of this invention is further stated to details below.

[0029] In the particle size distribution by the projected area diameter measured by the flow type particle image measuring device, 0.950-0.995, and that it is 0.960-0.995 preferably have [the toner of this invention] desirable average circularity. It is computed by the arithmetical mean of the circularity by which a flow type particle image measuring device is equipment which performs image analysis of a particle image pick-up statistically, and average circularity was called for here by the degree type using this equipment.

[0030]

[External Character 1]

$$\text{円形度} = \frac{\text{相当円の周囲長}}{\text{粒子投影像の周囲長}}$$

[0031] In a top type, the boundary length of a particle projection image is the length of the border line which connects the edge point of the particle image by which binarization was carried out, and is obtained, and is the length of the periphery of the circle which has the same area as the particle image by which binarization was carried out to the boundary length of a considerable circle.

[0032] Since friction with the member to which the average circularity of a toner gives a charge to the toner like toner particles or a toner particle, and toner support less than by 0.950 becomes large, failure of a toner particle and atomization arise and it becomes fogging control and an image inferior to highly minute nature. In the case where the average circularity of a toner exceeds 0.995, it becomes the toner with which electrification by friction is hard to be performed, and becomes an image inferior to homogeneity.

[0033] The toner of this invention is good to have the maximal value X in 3.0-9.0 micrometers of projected area diameters, to have the maximal value Y in 0.60-2.00 micrometers of projected area diameters, and to contain the or more 0.60 projected area diameter [less than 2.00 micrometer] particle several 8.0-30.0% in the particle size distribution by the projected area diameter measured by the flow type particle image measuring device. The particle which constitutes the maximal value Y here is bearing the role which reduces a fluidity even to a proper value.

[0034] In the particle size distribution by the projected area diameter of the particle measured by the flow type particle image measuring device, since a fluidity serves as a good toner superfluously, in the first stage, frictional electrification of a toner is not fully performed, but nonuniformity produces the spherical toner which has only a single peak in an initial image. Since a fluidity serves as a good toner superfluously also when the content of a 0.60-micrometer or more projected area diameter [less than 2.00 micrometer] particle is less than several 8.0%, nonuniformity arises in an initial image. Since the fluid fall effect works superfluously and serves as a bad fluid toner when the content of a 0.60-micrometer or more projected area diameter [less than 2.00 micrometer] particle exceeds several 30.0%, the initial image after long-term

neglect becomes an ill-behaved **** thing.

[0035] In addition, the above-mentioned effect is desirable from becoming more remarkable, when a middle imprint object is used as the image formation method. Although the detailed device is unknown, when forming a full color image on a middle imprint object, for example using a color toner, he is making the fluidity of a toner into a suitable value, and it is thought that it has prevented that are hard coming to win popularity the effect of the micro vibration produced from a drive system, and the toner image on a middle imprint object will become un-minute.

[0036] The method for obtaining the maximal value X and Y in the particle size distribution by the projected area diameter in this invention, and as a method of adjusting the content of the particle which has 0.60-micrometer or more less than 2.00-micrometer projected area diameter the emulsification particle made to subgenerate in case a toner particle was manufactured by the method; polymerization method which adds suitably the particle which does not do a bad influence about toner deterioration, for example although not limited especially — the object for the whole quantity — **** method; wet classification — By removing a part of emulsification particle subgenerated using the classification method like pneumatic elutriation, it is possible to use the method using some emulsification particles.

[0037] The method of controlling the polymerization conditions at the time of manufacturing a toner particle by the method of controlling the conglomeration processing conditions at the time of carrying out conglomeration processing of the toner particle manufactured by the grinding method, for example as a method of manufacturing the toner which has the specific average circularity mentioned above in this invention, and manufacturing a toner, and the polymerization method, and manufacturing a toner is mentioned.

[0038] As a method of carrying out conglomeration processing of the toner particle manufactured by the grinding method Use a Henschel mixer and the dry-blending machine like a media disperser for binding resin and a coloring agent, and a pan, and they are made to carry out distributed mixing of the toner component like a release agent and an electric charge control agent as occasion demands at homogeneity. Melting kneading of the obtained mixture is carried out using the kneading machine like a pressurized kneader and an extruder. It pulverizes using the pulverizer which carries out coarse grinding after cooling the obtained kneading object using the classifier like a hammer mill, and the obtained coarse-grinding object is made to collide with a target, and is made to pulverize it by jet mind flowing down, a classification removes coarse powder and fines using a classifier further, and particle size distribution are adjusted. The water bath method which the particle to which particle size distribution were adjusted distributes for example, a toner particle underwater, and is heated; conglomeration processing is performed by mechanical shock method; which gives the impulse force according heat-treating method; which passes the inside of a heat air current for a toner particle, or a toner particle to mechanical energy. The circularity of a toner can be adjusted by controlling suitably the processing temperature at the time of performing this conglomeration processing, the processing time, and the processing conditions like processing energy.

[0039] A homomixer is made to distribute a coloring agent and the monomer constituent added the toner component like a release agent and an electric charge control agent with the polymerization initiator as occasion demands further, and homogeneity was made to dissolve or distribute with a homogenizer and the mixer like an ultrasonic disperser in the aqueous phase containing a distributed stabilizer in a polymerization nature monomer as a method of manufacturing a toner particle by the polymerization method. A granulation is stopped in the phase where the size of the toner particle of a request of the drop which consists of a monomer constituent was obtained. What is necessary is just to perform after that churning which is the degree with which a particle condition is maintained and sedimentation of a particle is prevented according to an operation of a distributed stabilizer. Generally, polymerization temperature is set as the temperature of 50–90 degrees C, and performs 40 degrees C or more of polymerizations. the business of a toner — a temperature up may be carried out in the second half of a polymerization reaction, and in order to remove a still more nearly unreacted polymerization nature monomer and a by-product, basin system data medium may be distilled off in part after second half of reaction, or reaction termination, in order to adjust the molecular weight

distribution of binding resin. Washing and filtration recover the generated toner particle after reaction termination, and it dries. In a suspension-polymerization method, it is desirable to usually use water 300 – the 3000 weight sections as a dispersion medium to the monomer constituent 100 weight section.

[0040] The circularity of a toner can be adjusted by controlling the polymerization conditions like pH of the class of distributed stabilizer at the time of manufacturing a toner particle by the above-mentioned polymerization method and an amount, churning conditions, and the aqueous phase, and polymerization temperature.

[0041] In this invention, circularity distribution of the projected area diameter of a toner and the particle size distribution by the projected area diameter are measured using flow type particle image analysis apparatus FPIA-1000 (TOA Medical Electronics Co., Ltd. make) as follows.

[0042] Measurement removes detailed comfort through a filter and is ten to 3 cm³ as the result. About 0.02g of test portions was added to about 10ml (20 degrees C) of solutions with which the particle number of measuring range (less than 159.21 micrometers of for example, 0.60-micrometer or more projected area diameters) added the surfactant (preferably Wako Pure Chem contamination non) underwater 0.1 to 0.5% of the weight, and adjusted it to it at 20 or less ion exchange water, homogeneity was distributed, and sample variance liquid was prepared. As a means to distribute, ultrasonic disperser UH-50 made from incorporated company esthetic MUTE (vibrator is the titanium-alloy chip of 5phi) was used. Distributed time amount was considered as the above for 5 minutes, and at that time, it was suitably cooled so that the temperature of a dispersion medium might not become 40 degrees C or more. The particle size distribution of a particle and circularity distribution which have 0.60-micrometer or more less than 159.21-micrometer projected area diameter are measured using the above-mentioned flow type particle image analysis apparatus.

[0043] Although the outline of measurement is indicated by the operating manual and JP,8-136439,A of the catalog of FPIA-1000 of the TOA Medical Electronics [Co., Ltd.] Co., Ltd. issue (the June, 1995 version), and a measuring device, it is as follows.

[0044] Sample variance liquid passes the passage (it has spread along the flow direction) of a flat transparence flow cell (thickness of about 200 micrometers) in a flat. It crosses to the thickness of a flow cell, and it is equipped with a stroboscope and a CCD camera to a flow cell so that it may be mutually located in the opposite side, so that the optical path to pass may be formed. While sample variance liquid is flowing, in order that stroboscope light may obtain the image of a particle which is flowing the flow cell, it glares at intervals of 1 / 30 seconds, consequently each particle is photoed as a two-dimensional image which has a fixed range parallel to a flow cell. The diameter of circle which has the same area from the area of the two-dimensional image of each particle is computed as a projected area diameter. The circularity of each particle is computed by breaking the boundary length of the circle (considerable circle) which furthermore has the same area as the two-dimensional image of each particle by the boundary length of the two-dimensional image of each particle.

[0045] The range of 0.06-400 micrometers can be divided into 226 channels (it divides into 30 channels to one octave), and a result (frequency % and accumulation %) can obtain it as shown in a table 1. In actual measurement, a projected area diameter measures a particle in [0.60 micrometer or more] less than 159.21 micrometers.

[0046]

[A table 1]

粒径範囲(μm)	粒径範囲(μm)	粒径範囲(μm)	粒径範囲(μm)
0.60~0.61	3.09~3.18	15.93~16.40	82.15~84.55
0.61~0.63	3.18~3.27	16.40~16.88	84.55~87.01
0.63~0.65	3.27~3.37	16.88~17.37	87.01~89.55
0.65~0.67	3.37~3.46	17.37~17.88	89.55~92.17
0.67~0.69	3.46~3.57	17.88~18.40	92.17~94.86
0.69~0.71	3.57~3.67	18.40~18.94	94.86~97.63
0.71~0.73	3.67~3.78	18.94~19.49	97.63~100.48
0.73~0.75	3.78~3.89	19.49~20.06	100.48~103.41
0.75~0.77	3.89~4.00	20.06~20.65	103.41~106.43
0.77~0.80	4.00~4.12	20.65~21.25	106.43~109.53
0.80~0.82	4.12~4.24	21.25~21.87	109.53~112.73
0.82~0.84	4.24~4.36	21.87~22.51	112.73~116.02
0.84~0.87	4.36~4.49	22.51~23.18	116.02~119.41
0.87~0.89	4.49~4.62	23.16~23.84	119.41~122.89
0.89~0.92	4.62~4.76	23.84~24.54	122.89~126.48
0.92~0.95	4.76~4.90	24.54~25.25	126.48~130.17
0.95~0.97	4.90~5.04	25.25~25.99	130.17~133.97
0.97~1.00	5.04~5.19	25.99~26.75	133.97~137.88
1.00~1.03	5.19~5.34	26.75~27.53	137.88~141.90
1.03~1.06	5.34~5.49	27.53~28.33	141.90~146.05
1.06~1.09	5.49~5.65	28.33~29.16	146.05~150.31
1.09~1.12	5.65~5.82	29.16~30.01	150.31~154.70
1.12~1.16	5.82~5.99	30.01~30.89	154.70~159.21
1.16~1.19	5.99~6.16	30.89~31.79	159.21~163.86
1.19~1.23	6.16~6.34	31.79~32.72	163.86~168.64
1.23~1.26	6.34~6.53	32.72~33.67	168.64~173.56
1.26~1.30	6.53~6.72	33.67~34.65	173.56~178.63
1.30~1.34	6.72~6.92	34.65~35.67	178.63~183.84
1.34~1.38	6.92~7.12	35.67~36.71	183.84~189.21
1.38~1.42	7.12~7.33	36.71~37.78	189.21~194.73
1.42~1.46	7.33~7.54	37.78~38.88	194.73~200.41
1.46~1.50	7.54~7.76	38.88~40.02	200.41~206.28
1.50~1.55	7.76~7.99	40.02~41.18	206.28~212.28
1.55~1.59	7.99~8.22	41.18~42.39	212.28~218.48
1.59~1.64	8.22~8.46	42.39~43.62	218.48~224.86
1.64~1.69	8.46~8.71	43.62~44.90	224.86~231.42
1.69~1.73	8.71~8.96	44.90~46.21	231.42~238.17
1.73~1.79	8.96~9.22	46.21~47.56	238.17~245.12
1.79~1.84	9.22~9.49	47.56~48.94	245.12~252.28
1.84~1.89	9.49~9.77	48.94~50.37	252.28~259.64
1.89~1.95	9.77~10.05	50.37~51.84	259.64~267.22
1.95~2.00	10.05~10.35	51.84~53.36	267.22~275.02
2.00~2.06	10.35~10.65	53.36~54.91	275.02~283.05
2.06~2.12	10.65~10.96	54.91~56.52	283.05~291.31
2.12~2.18	10.96~11.28	56.52~58.17	291.31~299.81
2.18~2.25	11.28~11.61	58.17~59.86	299.81~308.56
2.25~2.31	11.61~11.95	59.86~61.61	308.56~317.56
2.31~2.38	11.95~12.30	61.61~63.41	317.56~326.83
2.38~2.45	12.30~12.66	63.41~65.26	326.83~336.37
2.45~2.52	12.66~13.03	65.26~67.16	336.37~346.19
2.52~2.60	13.03~13.41	67.16~69.12	346.19~356.29
2.60~2.67	13.41~13.80	69.12~71.14	356.29~366.69
2.67~2.75	13.80~14.20	71.14~73.22	366.69~377.40
2.75~2.83	14.20~14.62	73.22~75.36	377.40~388.41
2.83~2.91	14.62~15.04	75.36~77.56	388.41~400.00
2.91~3.00	15.04~15.48	77.56~79.82	
3.00~3.09	15.48~15.93	79.82~82.15	

*) 粒径範囲の上限は、その数値を含まず、「未満」を表わす。

[0047] The toner of this invention has a toner particle and external additive impalpable powder. External additive impalpable powder On a toner particle, independent or by having at least the non-subtlety powder (A) which exists in the condition of having condensed, and the non-globular form-like non-subtlety powder (B) generated when two or more particles united The amount distribution of frictional electrifications of a toner becomes Sharp, and the fluidity of a toner improves, and the toner deterioration by durability is controlled.

[0048] Non-subtlety powder (A) a toner particle surface top namely, by moving moderately The charge of the toner particle surface is made to equalize and the amount distribution of electrifications of a toner is made into Sharp, and it acts so that the fluidity of a toner may be raised. Non-globular form-like non-subtlety powder (B) By functioning as a spacer of a toner particle, it acts so that flaking to the toner particle of non-subtlety powder (A) may be controlled.

[0049] Generally, on the surface, when the member for giving a frictional electrification charge at the toner like a development sleeve is contacted, there are few locations where the external additive impalpable powder *(ed) by the toner particle surface outside escapes, the toner particle with it tends to be buried in the toner particle surface, and toner deterioration tends to produce it. [near / there is little irregularity and / a globular form]

[0050] Although average circularity is a toner near the globular form which are 0.950 thru/or 0.995 as mentioned above, the toner of this invention Since it has non-subtlety powder (A) and non-globular form-like non-subtlety powder (B) on the toner particle surface and has non-

globular form-like non-subtlety powder (B) on the toner particle surface as external additive impalpable powder, with non-globular form-like non-subtlety powder (B) Flasking on the toner particle surface of non-subtlety powder (A) is controlled effectively.

[0051] Non-subtlety powder (A) has the good individual number average major axis of the primary particle on a toner particle at the point that that less than 30 mmum is [1 or more mmum] 1mmum thru/or 25mmum preferably can raise the fluidity of the amount distribution of electrifications of a toner, and a toner good.

[0052] Since non-subtlety powder (A) is easily buried in the toner surface when the individual number average major axis of the primary particle of non-subtlety powder (A) is less than 1 mmum, toner deterioration arises with the use over a long period of time.

[0053] Since it is inferior to the capacity to make the charge of the toner particle surface equalize and the amount distribution of electrifications of a toner will become broadcloth when the individual number average major axis of the primary particle of non-subtlety powder (A) is 30 or more mmum, it is easy to produce problems, such as toner scattering and fogging.

[0054] The ratio (a major axis/minor axis) of the major axis of the primary particle on a toner particle and a minor axis is desirable, and non-subtlety powder (A) is good at the point which homogeneity can be made to distribute with a desirable gestalt, in case 1.0 thru/or 1.5, and that it is 1.0 thru/or 1.3 more preferably make the toner particle surface distribute non-subtlety powder (A).

[0055] Since the cohesive force of non-subtlety powder (A) becomes superfluous when the major axis and minor axis of a primary particle of non-subtlety powder (A) exceed 1.5, it becomes difficult to make homogeneity distribute non-subtlety powder (A) with a desirable gestalt on the toner particle surface using the churning mixer used widely.

[0056] Non-subtlety powder (A) is good at the point which shape factor SF-1 of the primary particle on a toner particle moves moderately [it is desirable and / 100 thru/or 130, and that it is 100 thru/or 125 more preferably] on a toner particle, and can give a good fluidity to a toner.

[0057] Since the capacity for non-subtlety powder (A) to move moderately in a toner particle surface top declines when shape factor SF-1 of the primary particle of non-subtlety powder (A) exceeds 130, it becomes an image inferior to concentration homogeneity or the toner for minute electrostatic-charge image development.

[0058] the value which sampled the particle image to 100-piece random using Hitachi nature FE-SEM (S-4700), and the image information introduced the image-analysis equipment made from NIKORE (Luzex 3) through the interface, analyzed in SF-1 which shows the shape factor in this invention, and was computed from the bottom type — constant — the bottom.

[0059]

[External Character 2]

$$\text{形状係数 (SF - 1)} = \frac{(\text{MXLNG})^2}{\text{AREA}} \times \frac{\pi}{4} \times 100$$

MXLNG shows the absolute maximum length of a particle among [type, and AREA shows the projected area of a particle.]

[0060] Measurement of the primary particle of non-subtlety powder (A) of shape factor SF-1 is performed using a 100,000 times as many enlargement as the toner by FE-SEM.

[0061] The specific surface area (BET specific surface area) by nitrogen adsorption with a BET adsorption method is desirable, and, as for non-subtlety powder (A), it is good 50 thru/or 150m2 / g, and that they are 60 thru/or 140m2 / g more preferably at the point which is easy to maintain the electrification nature of a toner particle at stability.

[0062] When the BET specific surface areas of non-subtlety powder (A) are under 50m2 / g, non-subtlety powder (A) becomes easy to break away from the toner particle surface, and it becomes easy to produce problems, such as toner scattering and fogging. Moreover, image concentration shall be inferior also to homogeneity.

[0063] When the BET specific surface area of non-subtlety powder (A) exceeds 150m2 / g and it is especially left over a long period of time in the bottom of highly humid, the electrification nature of a toner becomes unstable and it becomes easy to produce problems, such as toner

scattering and fogging.

[0064] In this invention, measurement of the BET specific surface area of fine particles is performed using specific-surface-area meter auto SOBU 1 made from QUANTACHROME as follows.

[0065] Measurement sample about 0.1g is ****(ed) in a cel, and degassing processing is performed for 12 hours or more by temperature [of 40 degrees C], and degree of vacuum 1.0×10^{-3} mmHg. Then, nitrogen gas is adsorbed in the condition of having cooled by liquid nitrogen, and a value is calculated by the multipoint method.

[0066] The non-globular form-like non-subtlety powder (B) used for this invention is good at the point that it is hard to move non-globular form-like non-subtlety powder (B) on a toner particle, and that shape factor SF-1 on a toner particle is larger than 150, and it large still more preferably [it is more desirable and / than 190] larger than 200 preferably can control flasking of the non-subtlety powder (A) to a toner particle good.

[0067] Since the non-globular form-like non-subtlety powder (B) itself becomes easy to be buried in the toner particle surface by shape factor SF-1 of non-globular form-like non-subtlety powder (B) at the case of 150 or less, the flasking depressor effect to the toner particle of non-subtlety powder (A) falls.

[0068] Measurement of shape factor SF-1 on the toner particle of non-globular form-like non-subtlety powder (B) is performed using a 50,000 times as many enlargement as the toner by SF-SEM.

[0069] As a configuration of non-globular form-like non-subtlety powder (B), a mere thing [being generated, cylindrical or when two or more particles as shown in heart-like drawing 10 instead of the shape of a non-globular form unite] is effective in respect of the flasking control to the toner particle of non-subtlety powder (A). The non-globular form-like non-subtlety powder (B) with which the reason was generated when two or more particles united While preventing burying non-globular form-like non-subtlety powder (B) in a toner particle although it is the configuration which has a flection therefore, non-globular form-like non-subtlety powder (B) functions as a spacer on a toner particle, and it is considered for controlling flasking to the toner particle of non-subtlety powder (A).

[0070] Furthermore, non-globular form-like non-subtlety powder (B) has a preferably good individual number average major axis 600 mmum at 30 thru/or the point that it can function as a spacer on a toner particle 20 thru/or that they are 35 thru/or 300mmum more preferably good 300 mmum.

[0071] When the individual number average major axis of non-globular form-like non-subtlety powder (B) is less than 30 mmum, it becomes the non-subtlety powder (A) independent addition effect and a similar thing, and it becomes difficult to control flasking of non-subtlety powder (A).

[0072] When the individual number average major axis of non-globular form-like non-subtlety powder (B) exceeds 60mmum, non-subtlety powder (A) comes to be buried in the toner particle surface, and it is easy to produce toner deterioration by **** of a toner particle and non-globular form-like non-subtlety powder (B).

[0073] It is good that ** (a major axis/minor axis) of the major axis on the toner particle of non-globular form-like non-subtlety powder (B) and a minor axis is 3.0 or more still more preferably 2.0 or more more preferably 1.7 or more at the point that the flasking depressor effect of the non-subtlety powder (A) to the toner particle surface is high.

[0074] When the major axis/minor axis of non-globular form-like non-subtlety powder (B) are less than 1.7, since non-globular form-like non-subtlety powder (B) will become deficient in crookedness structure, the non-globular form-like non-subtlety powder (B) itself becomes easy to be buried in the toner particle surface, and the flasking depressor effect to the toner particle of non-subtlety powder (A) falls.

[0075] Furthermore, non-globular form-like non-subtlety powder (B) is preferably [, on this toner particle] good to be generated when two or more 20mmum thru/or primary particles which have the Ferre minimum width of face of 30mmum thru/or 200mmum more preferably unite 200 mmum at the point that the flasking depressor effect of the non-subtlety powder (A) to the toner particle surface is high.

[0076] the churning mixer widely used since coherent [of non-globular form-like non-subtlety powder (B)] increases when the average Ferre minimum width of face of the primary particle which constitutes the coalescence particle of non-globular form-like non-subtlety powder (B) is less than 20 mmum — using it — a ratio — it becomes difficult to make homogeneity distribute globular form-like non-subtlety powder (B) on the toner particle surface.

[0077] crookedness structure becomes scarce when the average Ferre minimum width of face of the primary particle which constitutes the coalescence particle of non-globular form-like non-subtlety powder (B) exceeds 200mmum — in addition, non-subtlety powder (A) begins to be buried [come] in the toner particle surface, and it is not desirable at **** of a toner particle and non-globular form-like non-subtlety powder (B).

[0078] The specific surface area (BET specific surface area) by nitrogen adsorption with a BET adsorption method is desirable, and, as for non-globular form-like non-subtlety powder (B), it is good 20 thru/or 90m² / g, and that they are 25 thru/or 70m² / g more preferably at the point which does not bar the addition effect of non-subtlety powder (A).

[0079] Since non-subtlety powder (A) will already be embedded on the toner particle surface with non-globular form-like non-subtlety powder (B) in the case of the churning actuation which uses the churning mixer used widely when the surface areas-ed [BET] of non-globular form-like non-subtlety powder (B) are under 20m² / g, the addition effect of non-subtlety powder (A) decreases.

[0080] When the BET specific surface area of non-globular form-like non-subtlety powder (B) exceeds 90m² / g, non-subtlety powder (A) will be incorporated inside the pore of non-globular form-like non-subtlety powder (B), and the addition effect of non-subtlety powder (A) decreases.

[0081] In this invention, it sets to the electron microscope enlargement of a toner. The sum total of the primary particle of the non-subtlety powder (A) which exists in the condition of having condensed independently [per 0.5micrometerx0.5micrometer area] preferably on an average 20 or more pieces. It exists on the surface of a 25 or more piece toner particle more preferably, non-globular form-like non-subtlety powder (B) is an average per 1.0micrometerx1.0micrometer area, and it is preferably good 1 thru/or for 20 pieces to exist on the surface of 2 thru/or a 18-piece toner particle still more preferably. In addition, the total number of the primary particle of the non-subtlety powder (A) which exists on the surface of a toner particle means the total of the primary particle which exists independently, and the primary particle which constitutes floc.

[0082] The sum total of the primary particle of the non-subtlety powder (A) which exists on a toner particle serves as a toner inferior to a fluidity on an average at less than 20 cases, and serves as an image inferior to homogeneity.

[0083] Measurement of the external additive impalpable powder's in ratio [of an individual number average major axis, a major axis and a minor axis], average Ferre minimum width-of-face, and the toner particle surface's of external additive impalpable powder in this invention existence number is performed as follows.

[0084] Although measurement of each numeric value of non-subtlety powder (A) takes the photograph of the toner particle surface expanded by 100,000 times by scanning electron microscope FE-SEM (Hitachi make S-4700) and performs a major axis 1 thru/or the particle of 40mmum as the measuring object using the enlargement, it performs magnifying power suitably in the 100,000 sections thru/or the 500,000 times as many range as this in measurement of the major axis of a primary particle, and a minor axis as mentioned later.

[0085] The average major axis of the primary particle of non-subtlety powder (A) carries out rear-spring-supporter measurement of the major axis of the primary particle of non-subtlety powder (A) in an enlargement at ten visual fields, and makes the average an average major axis. Furthermore, the average of the minor axis of the primary particle of non-subtlety powder (A) was similarly calculated as an average minor axis, and the ratio of an average major axis and an average minor axis was computed as a ratio (a major axis/minor axis) of the major axis of the primary particle of non-subtlety powder (A), and a minor axis. In addition, make into a major axis distance between the parallel lines with which between the parallel lines serves as max among the parallel lines drawn so that the outline of the primary particle of non-subtlety powder (A)

might be touched, and let distance between the parallel lines with which between parallel lines serves as min be a minor axis.

[0086] In addition, in the case of 1mm or less, to a 500,000 times as many range as this, the diameter of measurement expands the magnifying power of the enlargement of the toner particle surface suitably, and measures it on an observation scale at the time of measurement of the major axis of non-subtlety powder (A), and a minor axis.

[0087] The non-subtlety powder's (A's)'s in the toner particle surface existence number counted the number of the primary particle of the non-subtlety powder (A) per toner particle surface 0.5micrometerx0.5micrometer (it sets to a 100,000 times as many enlargement as this, and is 50mmx50mm) area with enlargement 10 visual field, and asked for it by computing the average. When counting the number of non-subtlety powder (A), the number of the primary particle which constitutes floc was counted about the non-subtlety powder (A) condensed for the non-subtlety powder (A) which exists in the portion equivalent to 0.5micrometerx0.5micrometer of the core of an enlargement.

[0088] Measurement of each numeric value of non-globular form-like non-subtlety powder (B) took the photograph of the toner particle surface expanded by 50,000 times by scanning electron microscope FE-SEM (Hitachi make S-4700), and performed the particle of 20 or more mmum of major axes as the measuring object using the enlargement.

[0089] In an enlargement, the average major axis of non-globular form-like non-subtlety powder (B) carries out rear-spring-supporter measurement, and makes the major axis of non-globular form-like non-subtlety powder (B) the mean major axis at ten visual fields. Furthermore, the average of the minor axis of non-globular form-like non-subtlety powder (B) was similarly calculated as an average minor axis, and the ratio of an average major axis and an average minor axis was computed as a ratio (a major axis/minor axis) of the major axis of non-globular form-like non-subtlety powder (B), and a minor axis. In addition, make into a major axis distance between the parallel lines with which between the parallel lines serves as max among the parallel lines drawn so that the outline of non-globular form-like non-subtlety powder (B) might be touched, and let distance between the parallel lines with which between parallel lines serves as min be a minor axis.

[0090] The non-globular form-like non-subtlety powder's (B's)'s in the toner particle surface existence number counted the number of the non-globular form-like non-subtlety powder (B) per toner particle surface 1.0micrometerx1.0micrometer (it sets to a 50,000 times as many enlargement as this, and is 50mmx50mm) area with enlargement 10 visual field, and asked for it by computing the average. It was aimed at the non-globular form-like non-subtlety powder (B) which exists in the portion equivalent to 1.0micrometerx1.0micrometer of the core of an enlargement when counting the number of non-globular form-like non-subtlety powder (B).

[0091] The average Ferre minimum width of face of the primary particle which constitutes the coalescence particle of non-globular form-like non-subtlety powder (B) In an enlargement, non-globular form-like non-subtlety powder (B) is sampled 20 or more rear spring supporters within two or more visual fields. All the things within the visual field which can measure the Ferre minimum width of face of the primary particle which constitutes the coalescence particle of the sampled non-globular form-like non-subtlety powder (B) measure, and make the average the average Ferre minimum width of face. In addition, let distance used as the min between two parallel lines drawn so that the outline of the primary particle which constitutes the coalescence particle of non-globular form-like non-subtlety powder (B) might be touched be the Ferre minimum width of face.

[0092] The discernment from the non-subtlety powder (A) and non-globular form-like non-subtlety powder (B) by the scanning electron microscope enlargement When a difference has the particle shape of non-subtlety powder clearly When there is a presentation difference of the method of judging by the difference in the particle shape in a scanning electron microscope enlargement or non-subtlety powder The method of judging non-subtlety powder (A) and non-globular form-like non-subtlety powder (B) by detecting separately can be used by detecting only the specific element specified by the X-ray microanalyser.

[0093] In this invention, it is desirable that non-subtlety powder (A) and/or non-globular form-

like non-subtlety powder (B) contain silicone oil. While the hydrophobicity of this non-subtlety powder improves by processing this non-subtlety powder by silicone oil, it can prevent that the electrification property of a toner becomes an ununiformity by live-part material being damaged with this non-subtlety powder in a nonmagnetic 1 component development method. at this time, particle blot appearance of the silicone oil is carried out from this non-subtlety powder, and it is imagined to be what has played a role of lubricant.

[0094] In this invention, it is desirable that non-subtlety powder (A) and/or non-globular form-like non-subtlety powder (B) are inorganic compounds. When non-subtlety powder (A) is an organic compound, it becomes the configuration which deforms and is easy to fix on a toner particle surface with the use over a long period of time. On the other hand, when non-globular form-like non-subtlety powder (B) is an organic compound, it deforms or collapses and is inferior to the work as a spacer particle with friction with live-part material.

[0095] Although a conventionally well-known thing can be used as the non-subtlety powder (A) used for this invention, and (B), it is desirable to be chosen out of a silica, an alumina, titanias, or those suboxides because of electrification stability, development nature, a fluidity, and the improvement in shelf life. It is more desirable at the point that especially a silica can control the formation of primary particle size, or coalescence-ization of a primary particle to arbitration to some extent according to a start material or the oxidation conditions like temperature especially. For example, although this silica has usable both of the wet silica manufactured from the dry-process silica called the so-called dry process or the fumed silica generated by vapor phase oxidation of a silicon halogenide or an alkoxide and an alkoxide, and water glass, few dry type silicas of the manufacture residue like Na_2O and SO_3^{2-} with few [and] silanol groups in the interior of the surface and silica pulverized coal are more desirable.

[0096] As for non-globular form-like non-subtlety powder (B), being especially manufactured by the following processes is desirable.

[0097] When silica impalpable powder is made into an example, non-ball-like silica impalpable powder is manufactured by carrying out vapor phase oxidation of the silicon halogenated compound by generating silica impalpable powder and carrying out hydrophobing processing of the obtained silica impalpable powder. It is desirable especially in the case of vapor phase oxidation to calcinate at the elevated temperature which is the degree with which the primary particle of a silica is united.

[0098] Such non-globular form-like non-subtlety powder (B) has especially the desirable thing for which what adjusted particle size distribution so that a comparatively coarse particle might be extracted for the coalescence particle with which primary particles were united by the classification and the conditions of the individual number average major axis in the existence condition on a toner particle might be fulfilled is used.

[0099] the toner of this invention — the toner particle 100 weight section — receiving — non-subtlety powder (A) — desirable — 0.1 thru/or 3 weight sections — more — desirable — 0.2 thru/or carrying out 2 weight **** — good — non-globular form-like non-subtlety powder (B) — desirable — 0.1 thru/or 3 weight sections — it is more preferably good 0.2 thru/or to carry out 1.5 weight ****.

[0100] Since it becomes impossible to give sufficient fluidity for a toner when the amount of the non-subtlety powder (A) which a toner has is under the 0.1 weight section, it becomes an image inferior to homogeneity.

[0101] When the amount of the non-subtlety powder (A) which a toner has exceeds 3 weight sections, in order that non-subtlety powder (A) may separate from the toner particle surface and may form much flocs of non-subtlety powder (A), it becomes an image inferior to fogging in the paper and thin line expression nature.

[0102] When the amount of the non-globular form-like non-subtlety powder (B) which a toner has is under the 0.1 weight section, the addition effect of non-globular form-like non-subtlety powder (B) is not fully demonstrated, but image homogeneity falls with the use over a long period of time.

[0103] When the amount of the non-globular form-like non-subtlety powder (B) which a toner has exceeds 3 weight sections, in order that non-globular form-like non-subtlety powder (B) may

separate from the toner particle surface and may form much flocs of non-globular form-like non-subtlety powder (B), it becomes an image inferior to fogging in the paper and thin line expression nature.

[0104] In addition to the above-mentioned inorganic impalpable powder (A) and non-globular form-like non-subtlety powder (B), in the toner of this invention, the particle of further others can be added as an external additive if needed.

[0105] It is possible to use the organic or inorganic particle generally widely known to such a particle as an external additive.

[0106] As a non-subtlety particle, carbide (silicon carbide), a metal salt (a calcium sulfate, a barium sulfate, calcium carbonate), a fatty-acid metal salt (zinc stearate, calcium stearate), and a carbon black silica can be used. As an organic particle, the homopolymer or copolymer of a monomer component by the emulsion-polymerization method or the spray-drying method used for the binding resin for toners like styrene, an acrylic acid, methyl methacrylate, butyl acrylate, and 2-ethylhexyl acrylate can be used, for example.

[0107] Surface treatment which forms in the particle surface the alumina coat which performs silane coupling processing can be performed to the particle used for the toner of this invention to a particle in order to raise the operability of the particle size and configuration control which raise hydrophobicity and raise environmental capability further.

[0108] Specifically as a silane coupling agent, hexamethyldisilazane or the thing shown by the following formula (1) is mentioned.

[0109]

[External Character 3]

$R_m Si Y_n \cdots (1)$

R : アルコキシ基または、塩素原子

m : 1 ~ 3 の整数

Y : アルキル基、または、ビニル基、グリシドキシ基または
メタクル基を含む炭化水素基

n : 1 ~ 3 の整数

[0110] As a compound shown by the above-mentioned formula (1), a dimethyl dichloro silane, a trimethyl KURORU silane, an allyl compound dimethyl KURORU silane, an allyl compound phenyl dichloro silane, a benzyl dimethyl KURORU silane, vinyltriethoxysilane, gamma-methacryloxypropyltrimethoxysilane, vinyltriacetoxysilane, a divinyl KURORU silane, and a dimethyl vinyl KURORU silane can be mentioned typically, for example.

[0111] Either the dry process to which the silane coupling agent which evaporated pulverized coal as the method of silane coupling agent processing to what was made into the shape of a cloud by churning is made to react, or the wet method which distributes pulverized coal in a solvent and carries out the dropping reaction of the silane coupling agent can be processed.

[0112] As a method of making an alumina coat forming, in an aqueous solution or a solvent, an aluminum chloride, an aluminium nitrate, an aluminium nitrate, etc. can be added, a method [which is immersed and dries a particle] or water alumina, and water alumina-silica, water alumina-titania, and water alumina titania-silica, or water alumina-titania-silica-zinc oxide can be added, and a particle can be carried out by the method of immersing and drying in the aqueous solution.

[0113] The toner particle contained in the toner of this invention contains binding resin and a coloring agent at least.

[0114] As binding resin of the toner concerning this invention, polystyrene, the styrene like polyvinyl toluene, and the single polymer, styrene-propylene copolymer of the substitution product, A styrene-vinyltoluene copolymer, a styrene-vinyl naphthalene copolymer, A styrene-methyl-acrylate copolymer, a styrene-ethyl-acrylate copolymer, A styrene-butyl acrylate copolymer, a styrene-acrylic-acid octyl copolymer, A styrene-acrylic-acid dimethylaminoethyl copolymer, a styrene-methyl-methacrylate copolymer, A styrene-ethyl methacrylate copolymer,

a styrene-methacrylic-acid butyl copolymer, A styrene-dimethylaminoethyl methacrylate copolymer, a styrene-vinyl methyl ether copolymer, A styrene-vinyl ethyl ether copolymer, a styrene-vinyl methyl ketone copolymer, A styrene-butadiene copolymer, a styrene-isoprene copolymer, a styrene-maleic-acid copolymer, The styrene system copolymer like a styrene-maleate copolymer, Polymethylmethacrylate; Poly butyl methacrylate; polyvinyl acetate; — polyethylene; — polypropylene; — polyvinyl-butylal; — polyacrylic resin; — rosin; — denaturation rosin; — terpene resin; — phenol resin; — aliphatic series or alicycle group hydrocarbon resin; — aromatic series system petroleum resin; — paraffin wax; — carnauba wax is mentioned. these are independent — or it can be mixed and used.

[0115] As for the coloring agent used for the toner concerning this invention, what was toned black using carbon black, the magnetic substance, and the yellow / Magenta / cyanogen coloring agent that shows below is used as a black coloring agent.

[0116] As a yellow coloring agent, the compound represented by a condensation azo compound, an isoindolinone compound, the Anthraquinone compound, an azo metal complex, a methine compound, and the allyl compound amide compound is used. Specifically, the C.I. pigment yellow 12, 13, 14, 15, 17, 62, 74, 83, 93, 94, 95, 109, 110, 111, 128, 129, 147, 168, and 180 is used suitably.

[0117] As a Magenta coloring agent, a condensation azo compound, a diketo pyrrolo pyrrole compound, Anthraquinone, the Quinacridone compound, a base color lake compound, a naphthol compound, a benzimidazolone compound, a thioindigo compound, and a perylene compound are used. The C.I. pigment red 2, 3, 5, 6, 7, 23, 48:2, 48:3, 48:4, 57:1, 81:1, 122, 144, 146, 166, 169, 177, 184, 185, 202, 206, 220, 221, and 254 is especially specifically desirable.

[0118] As a cyanogen coloring agent, a copper-phthalocyanine compound and its derivative, the Anthraquinone compound, a base color lake compound, etc. can be used. Specifically, the C.I. pigment blues 1, 7, 15, 15:1, 15:2, 15:3, 15:4, 60, and 62 and 66 grades can use suitably especially.

[0119] these coloring agents are independent — or it can mix and can use in the state of the solid solution further.

[0120] In the case of a color toner, the coloring agent of this invention is chosen from the point of a hue angle, saturation, lightness, weatherability, OHP transparency, and the dispersibility to the inside of a toner. To the resin 100 weight section, the addition of this coloring agent carries out 1–20 weight section addition, and is used.

[0121] An electric charge control agent can be used for the toner of this invention if needed.

[0122] Although a well-known thing can be used as an electric charge control agent used for this invention, the electric charge control agent which can stabilize for it and maintain the amount of electrifications with it by colorlessness especially in the case of a color toner is desirable. [a quick and electrification speed of a toner and] [fixed]

[0123] As a concrete compound, the macromolecule mold compound which has a salicylic acid, a naphthoic acid, a dicarboxylic acid, the metallic compounds of those derivatives, a sulfonic acid, and a carboxylic acid in a side chain as a negative system, a boron compound, a urea compound, a silicon compound, and a cury KUSUA lane are mentioned, and the macromolecule mold compound which has quarternary ammonium salt and this quarternary ammonium salt in a side chain as a positive system, a guanidine compound, and an imidazole compound are mentioned.

[0124] An electric charge control agent has desirable 0.5 – 10 weight section to the binding resin 100 weight section. However, it is using frictional electrification with a carrier, when addition of an electric charge control agent is not indispensable and the 2 component development method's is used in this invention, and using positively frictional electrification with a blade member or a sleeve member, when the nonmagnetic 1 component blade coating development method's is used, and an electric charge control agent does not necessarily need to be included in a toner.

[0125] A wax can be used for the toner of this invention as low softening temperature material if needed.

[0126] As low softening temperature material used for the toner of this invention, the derivative

like paraffin wax, a polyolefine wax, a micro crystallin wax, the polymethylene wax like the Fischer TOROPISSHU wax, an amide wax, a higher fatty acid, long-chain alcohol, ester wax and these graft compounds, and a block compound is mentioned. As for these, what has the sharp maximum endothermic peak of the DSC endothermic curve from which the low molecular weight constituent was removed is desirable.

[0127] As a wax used preferably, the alkyl alcohol, the straight chain-like fatty acid, the straight chain-like acid amide, the straight chain-like ester, or the MONTAN system derivative of the shape of a straight chain of 15-100 carbon numbers is mentioned. What has removed the impurity like a liquefied fatty acid from these waxes beforehand is desirable.

[0128] Furthermore, the wax used preferably Alkylene polymer of the low molecular weight which used alkylene under high pressure, used a Ziegler catalyst or other catalysts under a radical polymerization or low voltage, and carried out the polymerization; The alkylene polymer of the amount of macromolecules is pyrolyzed. What carried out separation purification of the low-molecular-weight alkylene polymer which carries out a byproduction in case the polymerization of the alkylene polymer; alkylene obtained is carried out; from residue on distillation of the hydrocarbon polymer obtained from the synthesis gas which consists of a carbon monoxide and hydrogen by the AGE method Or the polymethylene wax which carried out extract judgment of the specific component is mentioned from the synthetic hydrocarbon which hydrogenates ***** and is obtained. The antioxidant may be added by these waxes.

[0129] As for the low softening temperature material used for this invention, in a DSC endothermic curve, it is desirable to have an endothermic Maine peak to a 40-90 degrees C (still more preferably 45-85 degrees C) field. Furthermore, an endothermic Maine peak has the desirable low softening temperature material of the Sharp melt nature whose half-value width is less than (preferably less than 5 degrees C) 10 degrees C. The ester wax with which low softening temperature material uses the ester compound of the long-chain alkyl alcohol of 15-45 carbon numbers and the long-chain alkyl carboxylic acid of 15-45 carbon numbers as a principal component especially is desirable in respect of the transparency in the sheet for OHP, the low-temperature fixable one at the time of fixing, and elevated-temperature-proof offset nature.

[0130] this invention — setting — measurement of DSC — for example, the product made from Perkin EREMA — DSC-7 are used. The temperature compensation of an equipment detecting element uses the indium heat of fusion about amendment of quantity of heat using the melting point of an indium and zinc. The sample set the empty pan to contrast using aluminum bread-making, and measured by carrying out a temperature up from 20 degrees C to 200 degrees C by the temperature up temperature of 10 degrees C / min.

[0131] low softening temperature material — the inside of a toner particle — the binding resin 100 weight section — receiving — desirable — 3 thru/or 40 weight sections — it is more preferably good 5 thru/or to carry out 35 weight sections oil impregnation.

[0132] When the content of low softening temperature material is under 5 weight sections, sufficient elevated-temperature-proof offset nature is hard to be obtained, and offset of the 1st image (surface) may arise further at the time of the 2nd fixing (rear face) at the time of image fixing to both sides of record material.

[0133] When the content of low softening temperature material exceeds 40 weight sections, in manufacturing a toner particle by the grinding method at the time of manufacture of a toner, it is easy to produce the welding of the toner component into a toner manufacturing installation, and in manufacturing a toner particle by the polymerization method, while granulation nature falls at the time of a granulation, it is easy to produce coalescence of toner particles.

[0134] In this invention, when obtaining a toner particle by the suspension-polymerization method, as a starting polymerization nature monomer styrene and o (m-) p — Methyl styrene, m Styrene system monomer; like (p-)—ethyl styrene A methyl acrylate, (Meta) An ethyl acrylate, (Meta) Acrylic-acid propyl, (Meta) Butyl acrylate, (Meta) Acrylic-acid octyl, (Meta) Acrylic-acid dodecyl, (Meta) Acrylic-acid stearyl, (Meta) Acrylic-acid behenyl, (Meta) 2-ethylhexyl acrylate, (Meta) Acrylic-acid dimethylaminoethyl, (Meta) The acrylic ester system monomer like an acrylic-acid diethylaminoethyl (meta); (Meta) The en system monomer like a butadiene, an isoprene, a cyclohexene, acrylonitrile (meta), and an acrylic-acid amide is used preferably.

Independently [these] or generally, a monomer is mixed suitably and the theoretical glass transition temperature (T_g) of a publication is used for 2nd edition III-p 139-192 (product made from John Wiley&Sons) of a publication polymer handbook so that 40-80 degrees C may be shown. When theoretical glass transition temperature is less than 40 degrees C, a problem arises from the field of the conservation stability of a toner, or the durable stability of a developer, when exceeding 80 degrees C on the other hand, the rise of an established point is brought about, especially in the case of a full color toner, the color mixture of each color toner becomes inadequate, and it is lacking in color reproduction nature, and the transparency of an OHP image is reduced further remarkably and it is not desirable from a high-definition field.

[0135] In the method of obtaining a toner particle using a suspension-polymerization method, especially although polar resin is added to coincidence from a viewpoint of making the polymerization reaction of a polymerization monomer performing without inhibition, and closing, it is desirable. As polar resin used for this invention, styrene, the copolymer of an acrylic acid (meta), a maleic-acid copolymer and polyester resin, and an epoxy resin are used preferably. Polar resin has especially the desirable thing that does not contain in a molecule a monomer and the partial saturation radical which can react.

[0136] As a polymerization initiator used by this invention, for example, 2 and 2'-azobis - (2,4-dimethylvaleronitrile), 2,2'-azobis isobutyronitrile, 1, and 1'-azobis (cyclohexane-1-carbonitrile), 2 and 2'-azobis-4-methoxy-2,4-dimethylvaleronitrile, The azo system polymerization initiator like azobisisobutyronitril; Benzoyl peroxide, The peroxide system polymerization initiator like methyl-ethyl-ketone peroxide, diisopropyl peroxy carbonate, cumene hydroperoxide, 2, 4-dichlorobenzoyl peroxide, and lauroyl peroxide is used.

[0137] Particle-size-distribution control of a toner particle and control of particle size can be finished by the method of controlling the method of changing the class or addition of a dispersant which carries out the mineral salt of difficulty water solubility, or a protective colloid operation, mechanical contrivance conditions, for example, the peripheral speed of a rotor, the count of pass and the stirring conditions like an impeller configuration, a container configuration, or the solid content concentration in the inside of an aqueous solution.

[0138] In this invention, it is desirable from the ability of removal of the residual monomer out of a toner particle for it to raise fixable [of a toner] that it is the toner particle which has the core/shell structure in which it was formed in with the polymer with which the shell portion was compounded by the polymerization, and the core section was formed by low softening temperature material, without reducing the blocking resistance of a toner, and carry out easily further.

[0139] As the concrete method of observing the tomographic layer of a toner particle in this invention After distributing a toner particle enough in the epoxy resin of room-temperature-setting nature, it is made to harden for two days in an ambient atmosphere with a temperature of 40 degrees C. After using 43 osmium <8> oxide together according to 43 ruthenium oxide and necessity and dyeing the obtained hardened material, the sample of a thin film integrated circuit was started using the microtome equipped with the diamond gear tooth, and the fault gestalt of a toner particle was observed using the transmission electron microscope (TEM). In this invention, in order to attach the contrast between materials using the difference in the degree of crystallinity of the some of the low softening temperature material which constitutes the core section to be used, and the resin which constitutes the shell section, it is desirable to use a 43 ruthenium-oxide staining technique.

[0140] As an one component system developer which has a toner, the toner of this invention can mix a carrier with a toner, and it can be used for it as a binary system developer.

[0141] When using the toner of this invention as a binary system developer, as a carrier, the iron which is not oxidized [scaling or], nickel, copper, zinc, cobalt, manganese, chromium, the acid metals like rare earth, those alloys, those oxides, and a ferrite can be used, for example. There is no constraint special as the manufacture method.

[0142] Furthermore, it is also desirable for the purpose, such as electrification adjustment, to cover the surface of the above-mentioned carrier particle with the cladding material which has resin. Although each well-known method like the method of making the cladding material which

has resin dissolve or suspend, applying it into a solvent, and making it adhere to a carrier as the method, or the method of only mixing by fine particles can apply conventionally, for stability of an enveloping layer, the method of dissolving and applying a cladding material into a solvent is more desirable.

[0143] As a cladding material to the surface of the above-mentioned carrier, although it changes with toner materials, although the copolymer of amino acrylate resin, acrylic resin, or those resin and styrene resin, silicone resin, polyester resin, a fluororesin, polytetrafluoroethylene, a monochloro trifluoro ethylene polymer, and polyvinylidene fluoride are used suitably, it is not necessarily restrained by this, for example. Although what is necessary is just to determine the amount of covering of these compounds suitably so that electrification grant specification of a carrier may be satisfied, it is good that it is generally 0.3 – 20 % of the weight more preferably 0.1 to 30% of the weight to a carrier in a total amount.

[0144] Although the ferrite particle which consists of a presentation of 98% or more of Cu-Zn-Fe (presentation ratio [5-20]:[5-20]: [30-80]) is typical as the quality of the material of the carrier used for this invention, if the engine performance is not spoiled, there is no constraint at all. You may be the thing of the gestalt like the resin carrier which furthermore consists of binding resin, a metallic oxide, and a magnetic metallic oxide.

[0145] an above-mentioned carrier and the mixing ratio of a toner particle — a good result will be obtained if a rate is preferably carried out to 3 – 8% of the weight two to 9% of the weight as toner concentration in a binary system developer. It becomes at less than 2 % of the weight, image concentration is low, and impossible to use toner concentration, if it exceeds 9 % of the weight, fogging and scattering inside the plane will increase and the useful life longevity of a developer will become short.

[0146] Next, the image formation method and equipment unit using a toner of this invention are explained using a drawing.

[0147] The schematic diagram of the image formation equipment which carries out the package imprint of the multiplex toner image for the image formation method of this invention at record material using a middle imprint object is shown in drawing 1 and drawing 8.

[0148] The schematic diagram of the image formation equipment which carries out the package imprint of the multiplex toner image for the image formation method of this invention at record material using a middle imprint drum is shown in drawing 1.

[0149] It is made to contact, rotating the pivotable electrification roller 2 with which the electrification bias voltage as live-part material was impressed to the surface of the photo conductor drum 1 as latent-image support, the photo conductor drum surface is primarily charged in homogeneity, and the 1st electrostatic latent image is formed on the photo conductor drum 1 by the laser light E emitted from the light equipment L as an exposure means. The 1st formed electrostatic latent image is developed with the black toner in black development counter 4Bk as the 1st development counter formed in the pivotable rotary unit 24, and forms a black toner image. The black toner image formed on the photo conductor drum 1 is primarily imprinted by operation of the imprint bias voltage impressed to the conductive base material of a middle imprint drum electrostatic on the middle imprint drum 5. Next, a rotary unit 24 is rotated, negatives are developed with the yellow toner in yellow development counter 4Y as the 2nd development counter, a yellow toner image is formed [the 2nd electrostatic latent image is formed in the surface of the photo conductor drum 1 like the above,], and a yellow toner image is primarily imprinted electrostatic on the middle imprint drum 5 on which the black toner image is imprinted primarily. Similarly, a rotary unit 24 is rotated for the 3rd electrostatic latent image and the 4th electrostatic latent image, as the Magenta toner and the 4th development counter in Magenta development counter 4M as the 3rd development counter, with the cyanogen toner in cyanogen development counter 4C, sequential development and a primary imprint are performed and the toner image of each color is primarily imprinted on the middle imprint drum 5, respectively. The multiplex toner image primarily imprinted on the middle imprint drum 5 is secondarily imprinted by package electrostatic on the record material P according to an operation of the imprint bias voltage from the 2nd imprint equipment 8 located in the opposite side through the record material P. Heating fixing of the multiplex toner image secondarily

imprinted on the record material P is carried out at the record material P by the anchorage device 3 which has a heating roller and a pressurization roller. The transfer residual toner which remains on the surface of the photo conductor drum 1 after an imprint is recovered by the cleaner which has the cleaning blade which contacts the surface of the photo conductor drum 1, and the photo conductor drum 1 is cleaned.

[0150] Imprint current is acquired because the primary imprint to the middle imprint drum 5 from the photo conductor drum 1 gives bias to the conductive base material of the middle imprint drum 5 as 1st imprint equipment from the power supply which is not illustrated, and the imprint of a toner image is performed.

[0151] The middle imprint drum 5 is set to conductive base material 5a which is the rigid body from wrap elastic layer 5b in the surface.

[0152] As conductive base material 5a, the conductive resin which distributed metals and alloys, such as aluminum, iron, copper, and stainless steel, a carbon metallurgy group particle, etc. can be used, and the shape of a cylinder, what penetrated the shaft at the cylindrical center, the thing which reinforced inside cylindrical, etc. are mentioned as the configuration.

[0153] Especially as elastic layer 5b, although not restrained, elastomer rubber, such as a styrene butadiene rubber, high styrene rubber, butadiene rubber, polyisoprene rubber, ethylene propylene rubber, nitril butadiene rubber (NBR), chloroprene rubber, isobutylene isoprene rubber, silicone rubber, a fluororubber, nitrile rubber, polyurethane rubber, acrylic rubber, EPIKUROROHIDORIGON, and polynorbornene rubber, is used suitably. Resin, and such copolymers and mixture, such as polyolefine system resin, silicone resin, fluorine system resin, and a polycarbonate, may be used.

[0154] Moreover, the surface layer which distributed lubricative and water-repellent high lubricant fine particles in the binder of arbitration may be prepared in the surface at the pan of an elastic layer.

[0155] Carbon fluoride, polytetrafluoroethylene (PTFE) which combined the fluorine with various fluororubbers, a fluorine elastomer, a graphite, or graphite although especially the limit did not have lubricant, Fluorine compounds, such as Pori fluoride [vinyl] DIN (PVDF), an ethylene-tetrafluoroethylene copolymer (ETFE), and a tetrafluoroethylene-perfluoroalkyl vinyl ether copolymer (PFA), Silicone system compounds, such as a silicone resin particle, silicone rubber, and a silicone elastomer, polyethylene (PE), polypropylene (PP), polystyrene (PS), acrylic resin, polyamide resin, phenol resin, an epoxy resin, etc. are used preferably.

[0156] Moreover, in order to control resistance in the binder of a surface layer, an electric conduction agent may be added timely. As an electric conduction agent, various kinds of conductive inorganic particles and carbon black, an ion system electric conduction agent, conductive resin, conductive particle distribution resin, etc. are mentioned.

[0157] Although the multiplex toner image on the middle imprint drum 5 is secondarily imprinted by package on the record material P with the 2nd imprint equipment 8, as an imprint means 8, its contact electrostatic image transfer means using a non-contact electrostatic image transfer means or an imprint roller, and an imprint belt with a corona-electrical-charging machine is usable.

[0158] By changing to the heat roller anchorage device which has heating roller 3a and pressurization roller 3b as an anchorage device 3, and heating the film which touches the toner image on the record material P, the toner image on the record material P can be heated, and the film heating anchorage device which carries out heating fixing of the multiplex toner image can also be used for the record material P.

[0159] It is also possible to replace with the middle imprint drum as a middle imprint object which the image formation equipment shown in drawing 1 uses, and to carry out the package imprint of the multiplex toner image at record material using a middle imprint belt. The configuration of a middle imprint belt is shown in drawing 8.

[0160] The toner image by which formation support was carried out on the photoconductor drum 1 is primarily imprinted one by one by the peripheral face of the middle imprint belt 10 by the electric field formed of the primary imprint bias impressed to the middle imprint belt 10 from the primary imprint roller 12 in the process in which the nip section of a photoconductor drum 1 and

the middle imprint belt 10 is passed.

[0161] A toner is reversed polarity and the primary imprint bias for the sequential superposition imprint of the toner image of the 1st – the 4th color from the photoconductor drum 1 to the middle imprint belt 10 is impressed from bias power supply 14.

[0162] In the primary imprint production process of the toner image of the 1st – the 3rd color from the photoconductor drum 1 to the middle imprint belt 10, secondary imprint roller 13b and the middle imprint belt cleaner 9 can also be estranged from the middle imprint belt 10.

[0163] 13b is a secondary imprint roller, it corresponds to secondary imprint opposite roller 13a, carries out bearing in parallel, and is arranged in the condition that it can estrange in the inferior-surface-of-tongue section of the middle imprint belt 10.

[0164] While secondary imprint roller 13b is contacted by the middle imprint belt 10, the contact nip of the middle imprint belt 10 and secondary imprint roller 13b is fed with the imprint material P to predetermined timing, and, as for the imprint to the imprint material P of the synthetic color toner image imprinted on the middle imprint belt 10, secondary imprint bias is impressed to secondary imprint roller 13b from bias power supply 16. A synthetic color toner image is secondarily imprinted by this secondary imprint bias from the middle imprint belt 10 to the imprint material P.

[0165] After image imprint ending to the imprint material P, the live-part material 9 for cleaning is contacted by the middle imprint belt 10, and the charge of a photoconductor drum 1 and reversed polarity is given to the toner (transfer residual toner) which remains on the middle imprint belt 10, without the imprint material P imprinting by impressing the bias of reversed polarity from bias power supply 15 in a photoconductor drum 1.

[0166] When said transfer residual toner is imprinted by the photoconductor drum 1 electrostatic [the nip section and near / its / the photoconductor drum 1], a middle imprint object is cleaned.

[0167] A middle imprint belt consists of a surface treatment layer prepared on the substratum of a belt configuration, and a substratum. In addition, the surface treatment layer may be constituted by two or more layers.

[0168] Rubber, an elastomer, and resin can be used for a substratum and a surface treatment layer. As rubber and an elastomer, for example, natural rubber, polyisoprene rubber, a styrene butadiene rubber, Butadiene rubber, isobutylene isoprene rubber, ethylene-propylene rubber, ethylene-propylene terpolymer, Chloroprene rubber, chlorosulfonated polyethylene, chlorinated polyethylene, acrylonitrile-butadiene rubber, polyurethane rubber, and syndiotactic one — 1 and 2-polybutadiene — Epichlorohydrin rubber, acrylic rubber, silicone rubber, a fluororubber, ****-ized rubber, poly polynorbornene rubber, hydrogenated nitrile rubber, and thermoplastic elastomer (for example, a polystyrene system —) a polyolefine system, a polyvinyl chloride system, a polyurethane system, a polyamide system, a polyester system, a fluororesin system, etc. — etc. — from — one kind chosen from the becoming group or two kinds or more can be used. However, it is not limited to the above-mentioned material. Moreover, as resin, resin, such as PORIERE fin system resin, silicone resin, fluorine system resin, and a polycarbonate, can be used. The copolymer and mixture of these resin may be used.

[0169] As a substratum, it can be used by making above-mentioned rubber, an elastomer, and resin into the shape of a film. Moreover, what covered above-mentioned rubber, an elastomer, and resin, was immersed, and sprayed such material on one side or both sides of an axis layer which carried out the shape of a textile-fabrics configuration, a nonwoven fabric configuration, and thread and a film configuration may be used.

[0170] The material which constitutes an axis layer For example, natural fiber; chitin fiber, such as cotton, silk, hemp, and wool, regenerated-fibers [, such as an alginate fiber and regenerated-cellulose fiber,]; — semi-synthetic fiber [, such as an acetate fiber,]; — polyester fiber — Nylon fiber, an acrylic fiber, polyolefine fiber, vinylon, Polyvinyl chloride fiber, polyvinylidene chloride fiber, a polyurethane fiber, Poly alkyl PARAOKISHI benzoate fiber, polyacetal fiber, an aramid fiber, Synthetic fibers, such as poly FURORO ethylene fiber and phenol fiber; one sort chosen from the group which consists of metal fibers, such as inorganic fiber; iron fiber, such as a carbon fiber, glass fiber, and a boron fiber, and copper fiber, or two sorts or more can be used.

Of course, it is not limited to the above-mentioned material.

[0171] Furthermore, in order to adjust the resistance of a middle imprint object, an electric conduction agent may be added in a substratum and a surface treatment layer. Although not limited especially as an electric conduction agent, one sort chosen from the group which consists of conductive high-molecular-compounds [, such as metallic-oxides /, such as metal powder; titanium oxide, /; such as carbon, aluminum and nickel, and a quarternary-ammonium-salt content polymethyl methacrylate, a polyvinyl aniline, a polyvinyl pyrrole the poly diacetylene, polyethyleneimine, a boron-bearing highly polymerized compound, and polypyrrole,]; etc., for example, or two sorts or more can be used. However, it is not limited to the above-mentioned electric conduction agent.

[0172] Moreover, in order to improve raising and imprint nature in the slipping nature of a middle imprint body surface, lubricant may be added if needed.

[0173] Carbon fluoride, polytetrafluoroethylene (PTFE) which combined the fluorine with various fluororubbers, a fluorine elastomer, a graphite, or graphite although especially the limit did not have lubricant, Fluorine compounds, such as Pori fluoride [vinyl] DIN (PVDF), an ethylene-tetrafluoroethylene copolymer (ETFE), and a tetrafluoroethylene-perfluoroalkyl vinyl ether copolymer (PFA); Silicone resin, Silicone system compound; (polyethylene PE); polypropylene (PP); (polystyrene PS); acrylic resin; polyamide resin, such as silicone rubber and a silicone elastomer; phenol resin; epoxy resin; etc. are used preferably.

[0174] Next, the toner image of each color is formed in two or more image formation section, respectively, and the image formation method which imprinted this in piles one by one to the same imprint material is explained based on drawing 2.

[0175] here — the 1st and the 2nd — 3rd and 4th image formation section 29a, 29b, 29c, and 29d it installs — having — **** — each image formation section — the electrostatic latent-image supporter of respectively dedication, so-called photoconductor drum 19a, 19b, and 19c And 19d It provides.

[0176] Photoconductor drum 19a Or 19d They are latent-image means forming 23a, 23b, and 23c to the periphery side. And 23d, development section 17a, 17b, and 17c And 17d, discharge section 24for imprint a, 24b, and 24c And 24d and cleaning section 18a, and 18b and 18c And 18d It is arranged.

[0177] By such configuration, it is 1st image formation section 29a first. Photoconductor drum 19a It is latent-image means forming 23a upwards. The latent image of a yellow component color is formed in a manuscript image. This latent image is development means 17a. It considers as a visible image with the developer which has a yellow toner, and is imprint section 24a. The record material S as imprint material imprints.

[0178] while the yellow image is imprinted by the imprint material S as mentioned above — 2nd image formation section 29b **** — the latent image of a Magenta component color — photoconductor drum 19b it forms upwards — having — continuing — development means 17b It considers as a visible image with the developer which has a Magenta toner. This visible image (Magenta toner image) is the above-mentioned 1st image formation section 29a. The imprint material S which the imprint ended is imprint section 24b. When carried in, the predetermined location of this imprint material S imprints in piles.

[0179] Hereafter, they are 3rd and 4th image formation section 29c and 29d by the same method as the above. Image formation of a cyanogen color and a black color is performed, and a cyanogen color and a black color are imprinted in piles to the imprint material S of the above-mentioned identitas. If such an image formation process is completed, the imprint material S will be conveyed by the fixing section 22, and will be established in the image on the imprint material S. A multi-colored picture image is obtained by this on the imprint material S. Each photoconductor drum 19a which the imprint ended, 19b, and 19c And 19d Cleaning section 18a, 18b, and 18c And 18d A residual toner is removed and it is offered for the next latent-image formation performed succeedingly.

[0180] With the above-mentioned image formation equipment, in addition, for conveyance of the record material S as imprint material In drawing 2, the imprint material S is conveyed from right-hand side by using the conveyance belt 25 to left-hand side, it is the conveyance process, and

they are each image formation section 29a, 29b, and 29c. And 29d Each imprint section 24a which can be set, 24b, and 24c And 24d It passes and an imprint is received.

[0181] In this image formation method, the conveyance belt using the thin dielectric sheet like the conveyance belt using the mesh of Dacron fiber and polyethylene terephthalate system resin, polyimide system resin, and urethane system resin is used from a viewpoint of the ease of processing as a conveyance means to convey imprint material, and endurance.

[0182] The imprint material S is the 29d of the 4th image formation sections. Electricity will be discharged and it will dissociate from a belt 25, and if it passes, after that, the imprint material S goes into a fixing assembly 22, and AC voltage will be applied to the electric discharge machine 20, and it will be discharged [image fixing will be carried out and] from an exhaust port 26.

[0183] In addition, the electrostatic latent-image supporter which became independent in that image formation section, respectively is provided, and imprint material is the conveyance means of a belt type, and one by one, it may consist of this image formation method so that it may be sent to the imprint section of each electrostatic latent-image supporter.

[0184] Moreover, it comes to provide the electrostatic latent-image supporter common to that image formation section, and it is the conveyance means of a drum type, imprint material is repeatedly sent to the imprint section of an electrostatic latent-image supporter, and it may consist of this image formation method so that the imprint of each color may be received.

[0185] However, by this conveyance belt, since the volume resistivity is high, a conveyance belt makes the amount of electrifications increase, and goes by the process [as / in color picture formation equipment] which repeats several imprints. For this reason, a uniform imprint is unmaintainable unless it carries out the sequential increment of the imprint current at every the imprint of each.

[0186] Even if electrification of a conveyance means increases whenever it repeats an imprint since this invention toner is excellent in imprint nature, the imprint nature of the toner in each imprint can be equalized with the same imprint current, and a good high definition image will be obtained.

[0187] Furthermore, the image formation method for forming the full color image of other operation gestalten is explained based on drawing 3.

[0188] The electrostatic latent image formed with the means suitable on a photoconductor drum 33 is visualized by the 1st developer in the development counter 36 as a development means attached in the rotation development unit 39 which rotates in the direction of an arrow head.

The color toner image on the photo conductor drum 33 is imprinted with the imprint electrification vessel 44 by the record material S as imprint material currently held on the imprint drum 48 with the gripper 47. The transfer residual toner which remains on the surface of a photoconductor drum 33 after an imprint is recovered by the cleaner 38 which has the cleaning blade which contacts the surface of a photoconductor drum 33, and a photoconductor drum 33 is cleaned.

[0189] When a corona-electrical-charging machine or a contact electrification machine is used for the imprint electrification machine 44 and a corona-electrical-charging machine is used for the imprint electrification machine 14, the voltage of $-10\text{kV} - +10\text{kV}$ is impressed to it, and it is imprint current. - It is $500\text{microA} - +500\text{microA}$. An attachment component is stretched by the peripheral face of the imprint drum 48, and this attachment component is constituted by the film-like dielectric sheet like a polyvinylidene fluoride resin film or polyethylene terephthalate. For example, the sheet of 100 micrometers - 200 micrometers in thickness, a volume resistivity $10^{12} - 10^{14} \text{ ohm-cm}$ is used.

[0190] Next, a rotation development unit rotates as two amorous glance, and a development counter 35 counters a photoconductor drum 33. And negatives are developed by the 2nd developer in a development counter 35, and this toner image is also imprinted in piles on the record material S as the same imprint material as the above.

[0191] Further 3 amorous glance and four amorous glance are performed similarly. Thus, the imprint drum 48 rotates only the count of predetermined, with the record material S as imprint material grasped, and the multiplex imprint of the toner image of the predetermined color number is carried out. The imprint current for carrying out electrostatic image transfer is desirable in

order that raising in order of Isshiki eye < two-color eye < 3 amorous-glance < 4 amorous glance may lessen the imprint residual toner which remains on a photoconductor drum.

[0192] On the other hand, if imprint current is made high, since a transfer picture will be disturbed, it is not desirable. However, since the toner of this invention is excellent in imprint nature, it can imprint firmly the two-color eye at the time of carrying out a multiplex imprint, three amorous glance, and no less than four amorous glance. Therefore, the image of what amorous glance is also formed exactly and the multi-colored picture image whose contrast was effective is obtained. Furthermore, in a full color image, the beautiful image excellent in color reproduction is obtained. And since it becomes unnecessary to raise imprint current so much, turbulence of the image in an imprint production process can be lessened. If the current at the time of electrostatic adsorption to the imprint belt of the record material S becoming large, and dissociating, if imprint current is large although electricity is discharged with the separation electrification vessel 45 in case the record material S is separated from the imprint drum 48 is not enlarged, it becomes impossible moreover, to dissociate. Since imprint current is reversed polarity when it does so, scattering of the toner from turbulence and the imprint material of a toner image will be produced, and the image formation equipment inside of a plane will be soiled. Since the toner of this invention is easy to imprint, separation current is not enlarged, but ** can also be good, can make separation easy and can prevent turbulence and toner scattering of the image at the time of separation as a result. Therefore, the toner of this invention is especially used for the image formation method which forms the multi-colored picture image which has a multiplex imprint production process, and a full color image preferably.

[0193] The separator electrical machinery 45 dissociates from the imprint drum 48, and it is fixed to the record material S by which the multiplex imprint was carried out by the heating pressurization roller fixing assembly 32 which has Webb who has sunk in silicone oil, and it becomes a full color copy image by carrying out additive color mixture at the time of fixing.

[0194] About the multiplex development package imprint method, full color image formation equipment is made into an example, and is explained based on drawing 4.

[0195] The electrostatic latent image formed on the photoconductor drum 103 in the exposure section 101 which used the electrification machine 102 and laser light develops a toner one by one with development counters 104, 105, 106 and 107, and is visualized. In a development process, the non-contact development method is used preferably. Since the developer layer in a development counter does not grind the surface of an image formation object according to the non-contact development method, negatives can be developed without disturbing the image formed at the development production process of precedence in the development production process of the 2nd henceforth.

[0196] The multicolor multiplex image and full color image which were formed on the photoconductor drum 103 are imprinted with the imprint electrification vessel 109 by the record material S as imprint material. In an imprint production process, the electrostatic image transfer method is used preferably and the corona discharge imprint method or the contact imprint method is used. The corona discharge imprint method is the method of arranging the imprint electrification machine 109 which produces corona discharge through the record material S as imprint material so that an image may be countered, making corona discharge act from the back of the record material S as imprint material, and imprinting electrostatic. The contact imprint method is the method of contacting an imprint roller and an imprint belt on an image formation object, and making impress bias to a roller through the record material S as imprint material, or imprinting electrostatic from the back of a belt. The multicolor toner image supported by the surface of a photoconductor drum 103 by this electrostatic image transfer method bundles up, and the record material S as imprint material imprints. Since there are many amounts of toners to imprint, an imprint residue increases, and it becomes easy to generate imprint nonuniformity and becomes easy to produce color nonuniformity by such package imprint method in a full color image.

[0197] However, the toner of this invention is excellent in imprint nature, and every color is exactly formed in a multi-colored picture image. The beautiful image which was excellent in color reproduction nature in the full color image is obtained. Furthermore, also by low current, since

imprint effectiveness is good, turbulence of the image at the time of an imprint can be lessened. Furthermore, since separation also becomes easy, turbulence toner scattering of the image at the time of separation can also be reduced. Furthermore, since it excels also in a mold-release characteristic, good imprint nature is shown also in a contact imprint means. Therefore, the toner of this invention is preferably used also for the image formation method of having a multiplex development package imprint production process.

[0198] The record material S by which the package imprint of the multicolor toner image was carried out becomes a multi-colored picture image by dissociating from a photoconductor drum 103 and being established by the heat roller fixing assembly 112.

[0199] The transfer residual toner which remains on the surface of a photoconductor drum 103 after an imprint is recovered by the cleaner 108 which has the cleaning blade arranged possible [contact on the surface of a photoconductor drum 103], and a photoconductor drum 103 is cleaned. The cleaning blade of this cleaner 108 is usually in the surface of a photoconductor drum 103, and alienation, and in case an imprint is performed to the record material S as imprint material from a photoconductor drum 103, it carries out movable [of it] so that the surface of a photoconductor drum 103 may be contacted.

[0200] Drawing 5 is explanatory drawing of image formation equipment using the imprint belt as a secondary imprint means at the time of imprinting collectively the color toner image of four colors primarily imprinted by middle imprint drum lifting using the middle imprint drum secondarily to record material.

[0201] In the process defined system shown in drawing 5, the developer which has the developer which has a cyanogen toner, respectively in a development counter 244-1, 244-2, 244-3, 244-4, the developer which has a Magenta toner, the developer which has a yellow toner, and a black toner is introduced, the electrostatic-charge image formed in the photo conductor 241 is developed, and each color toner image is formed on a photo conductor 241. A photo conductor 241 is a photoconductor drum or a sensitization belt with a-Se, Cds and ZnO₂, OPC, and a photoconduction insulating material layer like a-Si. A photo conductor 241 rotates in the direction of an arrow head with the driving gear which is not illustrated.

[0202] As a photo conductor 241, the photo conductor which has an amorphous silicon sensitization layer or an organic system sensitization layer is used preferably.

[0203] You may be the functional discrete-type sensitization layer which the monolayer mold with which a sensitization layer contains the material which has charge generating material and charge transportability ability in the same layer as an organic sensitization layer is sufficient as, or uses a charge generating layer as a component for a charge transportation layer. A charge generating layer and the laminating mold sensitization layer of the structure by which the laminating is subsequently carried out in the order of a charge transportation layer are one of the desirable examples on a conductive base.

[0204] Polycarbonate resin, polyester resin, and acrylic resin have [especially the binding resin of an organic sensitization layer] imprint nature and good cleaning nature, and poor cleaning, the welding of the toner to a photo conductor, and filming of an external additive cannot happen easily.

[0205] At an electrification production process, there are a method which is non-contact in the photo conductor 241 which uses a corona-electrical-charging machine, and a method of the contact mold using a roller etc., and anything is used. As shown in drawing 5 for the formation of efficient homogeneity electrification, simple-izing, and low ozone generating, the thing of a contact method is used preferably.

[0206] The electrification roller 242 considers rodding 242b of a center, and conductive elastic layer 242a in which the periphery was formed as a basic configuration. The electrification roller 242 has thrust in the 241st page of a photo conductor, and the pressure welding of it is carried out and it carries out follower rotation with rotation of a photo conductor 241.

[0207] When that to which the contact pressure of a roller is 5 - 500 g/cm, and superimposed alternating voltage on direct current voltage as desirable process conditions when using an electrification roller is used, it is alternating-voltage = 0.5 - 5kVpp, alternating current frequency = 50Hz-5kHz, and direct-current-voltage = **0.2-**1.5kV, and when direct current voltage is

used, it is direct-current-voltage $\approx 0.2\text{--}5\text{ kV}$.

[0208] There are a method using an electrification blade as other electrification means and a method using a conductive brush. These contact electrification means are effective in the high voltage becoming unnecessary or generating of ozone decreasing.

[0209] As the electrification roller as a contact electrification means, and the quality of the material of an electrification blade, conductive rubber is desirable and may prepare a mold-release characteristic coat in the surface. As a mold-release characteristic coat, nylon system resin, PVDF (polyvinylidene fluoride), PVDC (polyvinylidene chloride), etc. are applicable.

[0210] The toner image on a photo conductor is imprinted by the middle imprint drum 245 on which voltage (for example, $\approx 0.1\text{--}5\text{ kV}$) is impressed. The photo conductor surface after an imprint is cleaned with a cleaning means 249 to have a cleaning blade 248.

[0211] The middle imprint drum 245 is set to pipe-like conductive rodding 245b from elastic body layer 245a of resistance, while forming in the peripheral face. What performed conductive plating to the pipe of plastics is sufficient as rodding 245b.

[0212] Elastic body layer 245a of inside resistance is the layer of the solid or foaming texture which carried out combination distribution of the conductive grant material like carbon black, a zinc oxide, the tin oxide, and silicon carbide, and adjusted the electric resistance value (volume resistivity) to spring materials, such as silicone rubber, Teflon rubber, chloroprene rubber, polyurethane rubber, and EPDM (3 yuan copolymer of ethylene propylene diene), at resistance in $10^5\text{--}10^{11}\text{ ohm-cm}$.

[0213] The bearing of the middle imprint drum 245 is carried out in parallel to a photo conductor 241, it is contacted in the inferior-surface-of-tongue section of a photo conductor 241, is arranged, and rotates to the counterclockwise rotation of an arrow head with the same peripheral velocity as a photo conductor 241.

[0214] The middle imprint of the toner image of the 1st color by which formation support was carried out in the field of a photo conductor 241 is carried out one by one to the external surface of the middle imprint drum 245 by the electric field formed in the imprint nip region on the impression imprint bias to the middle imprint drum 245 by the process in which the imprint nip section which a photo conductor 241 and the middle imprint drum 245 touch is passed.

[0215] The surface of the middle imprint drum 245 is cleaned after the imprint of the toner image to imprint material by necessity with the cleaning means 280 which can be detached and attached freely. When a toner image is in middle imprint drum lifting, the cleaning means 280 is separated from a middle imprint body surface so that a toner image may not be disturbed.

[0216] Carry out a bearing in parallel to the middle imprint drum 245, the inferior-surface-of-tongue section of the middle imprint drum 245 is made to contact, an imprint means is arranged, and the imprint means 247 is for example, an imprint roller or an imprint belt, and is rotated to the clockwise rotation of an arrow head with the same peripheral velocity as a middle imprint drum. The imprint means may be arranged so that a direct middle imprint drum may be contacted, and it may be arranged so that a belt etc. may contact between a middle imprint drum and an imprint means.

[0217] In the case of an imprint roller, the conductive elastic layer in which rodding and its periphery were formed at the center is considered as a basic configuration.

[0218] It is possible to use a common material as a middle imprint drum and an imprint roller. While being able to mitigate the applied voltage to an imprint roller by setting up smaller the volume resistivity value of the elastic layer of an imprint roller and being able to form a good toner image on imprint material rather than the volume resistivity value of the elastic layer of a middle imprint drum, coiling round on the middle imprint object of imprint material can be prevented. It is especially desirable that the volume resistivity value of the elastic layer of a middle imprint object is especially 10 or more times from the volume resistivity value of the elastic layer of an imprint roller.

[0219] The degree of hardness of a middle imprint drum and an imprint roller is JIS. It is measured based on K-6301. As for the middle imprint drum used for this invention, it is desirable to consist of elastic layers belonging to the range of 10 – 40 degrees, and on the other hand, its degree of hardness of the elastic layer of an imprint roller is desirable, when what has the value

of 41 – 80 degrees more firmly than the degree of hardness of the elastic layer of a middle imprint drum prevents coiling round of the imprint material to a middle imprint drum. If the degree of hardness of a middle imprint drum and an imprint roller becomes reverse, a crevice will be formed in an imprint roller side and it will be easy to generate coiling round of the imprint material to a middle imprint drum.

[0220] In drawing 5, the imprint belt 247 is arranged under the middle imprint drum 245. Two rollers arranged in parallel to the shaft of the middle imprint drum 245, i.e., bias roller 247a, and tension roller 247c are built over the imprint belt 247, and it is driven by the driving means (un-illustrating). The imprint belt 247 can attach and detach from a lower part in the direction of an arrow head to the middle imprint drum 245 by constituting the bias roller 247a side movable in the direction of an arrow head focusing on the tension roller 247c side. Desired secondary imprint bias is impressed to bias roller 247a by 247d of sources of secondary imprint bias, and, on the other hand, tension roller 247c is grounded.

[0221] Next, although it was the imprint belt 247, the rubber belt which thermosetting urethane elastomer was made to distribute carbon, controlled by the gestalt of this operation upwards in about 300 micrometers in thickness, and 108–1012ohms of volume resistivities and cm (at the time of 1kV impression), and was controlled to 20 micrometers of fluororubbers and volume-resistivity 1015.ohm-cm (at the time of 1kV-impression) was used. The outer diameter size is a tube configuration with a perimeter 80x width of face of 300mm.

[0222] The tension impression which extends the above-mentioned imprint belt 247 about 5% by above-mentioned bias roller 247a and tension roller 247c is made.

[0223] The imprint means 247 distinguishes between the middle imprint drum 245, uniform velocity, or peripheral velocity, and is rotated. The toner image on the middle imprint drum 245 is imprinted at the surface side of the imprint material 246 by impressing the bias of the friction charge which a toner has, and reversed polarity to the imprint means 247 from 247d of sources of secondary imprint bias at the same time the imprint material 246 is conveyed between the middle imprint drum 245 and the imprint means 247.

[0224] As the quality of the material of the body of revolution for an imprint, the same thing as an electrification roller can also be used, as process conditions for a desirable imprint, the contact pressure of a roller is 5 – 500 g/cm, and direct current voltage is **0.2–**10kV.

[0225] For example, conductive elastic layer 247a1 of bias roller 247a It is built with the elastic body of the volume resistivity of 106–1010ohms and cm degree of a polyurethane [which distributed electric conduction material, such as carbon,], and ethylene-propylene-diene system ternary polymerization object (EPDM) etc. rodding 247a2 **** — bias is impressed according to the constant voltage power supply. As bias conditions, **0.2–**10kV is desirable.

[0226] Subsequently, the imprint material 246 is conveyed to the fixing assembly 281 which considers the pressurization roller of the elastic body by which the pressure welding was carried out with the heating roller, this, and thrust in which heating elements, such as a halogen heater, were made to build as a basic configuration, and heating pressurization fixing of the toner image is carried out by passing through between a heating roller and a pressurization roller at imprint material. The method established at a heater through a film may be used.

[0227] The binary system development method using the binary system developer which has the one component system development method, toner, and carrier which use an one component system developer is applicable to the developer (development counter) shown in above-mentioned drawing 1 thru/or above-mentioned drawing 5.

[0228] As a nonmagnetic toner, the development method using the one component system nonmagnetic developer which has the toner of this invention is explained based on the outline block diagram shown in drawing 6.

[0229] A developer 170 supports the one component system nonmagnetic developer 176 held in the development container 171 which holds the nonmagnetic one component system developer 176 as a nonmagnetic toner, and the development container 171. As developer thickness specification-part material for regulating the feed roller 173 for supplying an one component system nonmagnetic developer on the developer support 172 for conveying to a development field, and developer support, and the developer thickness on developer support It has the stirring

member 175 for stirring the one component system nonmagnetic developer 176 in the ***** blade 174 and the development container 171.

[0230] 169 is the latent-image support for supporting an electrostatic latent image, and latent-image formation is made by the electrophotography process means or electrostatic recording means which is not illustrated. 172 is a development sleeve as developer support, and consists of a nonmagnetic sleeve which consists of aluminum or stainless steel.

[0231] Although aluminum and a stainless rough pipe may be used for a development sleeve as it is, what sprayed the surface with the glass bead preferably, and was damaged to homogeneity, and its thing which carried out mirror plane processing or thing which carried out the coat by resin is good. The method of carrying out the coat of the sleeve surface by resin especially is distributing various particles in resin, and since adjusting sleeve surface roughness and conductivity or giving slippage to the sleeve surface can carry out simple, it is used suitably.

[0232] Although not limited especially about the various particles added by the resin and resin which are used for carrying out the coat of the sleeve surface, as resin, heat or photoresists, such as thermoplastics, such as stainless steel system resin, vinyl system resin, polyether sulphone resin, polycarbonate resin, polyphenylene oxide resin, polyamide resin, a fluororesin, fibrin system resin, and acrylic resin, an epoxy resin, polyester resin, an alkyd resin, phenol resin, melamine resin, polyurethane resin, a urea resin, silicone resin, and polyimide resin, are used suitably.

[0233] As various particles to add, moreover, PMMA, acrylic resin, a polybutadiene resin, Polystyrene resin, polyethylene, polypropylene, polybutadiene, Or these copolymers, benzoguanamine resin, phenol resin, polyamide resin, Resin particles, such as nylon, fluorine system resin, silicone resin, epoxy system resin, and polyester resin; Furnace black, Carbon black, such as lamp black, thermal black, acetylene black, and channel black; Titanium oxide, Metallic oxides, such as oxidation tin, a zinc oxide, molybdenum oxide, titanate acid potash, antimony oxide, and indium oxide; inorganic system bulking agents, such as metals, such as aluminum, copper, silver, and nickel, graphite, a metal fiber, and a carbon fiber, are used suitably.

[0234] The one component system nonmagnetic developer 176 is stored in the development container 171, and is supplied by the feed roller 173 to up to the developer support 172. the relative velocity which the feed roller 173 consists of the foam like polyurethane foam, and is not 0 to order or hard flow to developer support — having — rotating — supply of a developer — the developer after the development on the developer support 172 (developer non-developed negatives) — also stripping off — it is carrying out. The binary system nonmagnetic developer supplied on the developer support 172 is applied to homogeneity and a thin layer by the elastic blade 174 as developer thickness specification-part material.

[0235] The contact pressure force of an elastic spreading blade and developer support has preferably effective 0.5 – 12 kg/m 0.3 to 25 kg/m as a linear pressure of the direction of a development sleeve bus-bar. When the contact pressure force is smaller than 0.3 kg/m, homogeneity spreading of an one component system nonmagnetic developer becomes difficult, and the amount distribution of electrifications of an one component system nonmagnetic developer serves as broadcloth, and causes fogging and scattering. If the contact pressure force exceeds 25 kg/m, since a big pressure will be applied to an one component system nonmagnetic developer and an one component system nonmagnetic developer will deteriorate, it is not desirable that condensation of an one component system nonmagnetic developer occurs etc. Moreover, it is not desirable in order to require torque big in order to make developer support drive. That is, it becomes possible to unfold effectively condensation of the one component system nonmagnetic developer using the toner of this invention by adjusting the contact pressure force to 0.3 – 25 kg/m, and it becomes possible to start the amount of electrifications of an one component system nonmagnetic developer further in an instant.

[0236] As an elastic blade, silicone rubber, polyurethane rubber, the rubber elasticity object; polyethylene terephthalate like NBR, the elastomer; stainless steel like a polyamide, steel, and the metal elastic body like phosphor bronze can be used, and even if it is those complex further, it can be used. What carried out the injection molding of the various elastomers, such as rubber materials, such as urethane and silicone, and a polyamide elastomer, and prepared them

preferably on SUS which has spring elasticity, or the metallic thin plate of phosphor bronze is good.

[0237] In this nonmagnetic 1 component development method, in the system which carries out the thin layer coat of the one component system nonmagnetic developer on a development sleeve with a blade, in order to obtain sufficient image concentration, it is desirable to make thickness of the one component system nonmagnetic developer layer on a development sleeve smaller than the confrontation gap α of a development sleeve and latent-image support, and to impress alternation electric field to this gap. That is, by the bias power supply shown in drawing 6, by impressing the development bias which superimposed direct-current electric field to alternation electric field or alternation electric field between the development sleeve 172 and the latent-image support 169, migration of the one component system nonmagnetic developer from a development sleeve to an image support top can be made easy, and a still better image can be obtained.

[0238] As for the thickness of the developer layer which the gap α of latent-image support and developer support is set as 50–500 micrometers, and is supported on developer support, in this invention, being set as 40–400 micrometers is desirable.

[0239] A development sleeve is rotated with 100 – 200% of peripheral speed to latent-image support. Alternation bias voltage is preferably good to use [0.1kV or more / 0.2–3.0kV] by 0.3–2.0kV still more preferably at the peak to peak. 1.0–5.0kHz of 1.0–3.0kHz of alternation bias frequency is preferably used by 1.5–3.0kHz still more preferably. An alternation bias wave can apply the wave like a square wave, a sine wave, a sawtooth wave, and a triangular wave. Furthermore, the unsymmetrical AC bias from which the voltage of positive and reverse and time amount differ can also be used. It is also desirable to superimpose direct-current bias.

[0240] Next, the development method using the two component developer which consists of the toners and carriers of this invention as a nonmagnetic toner is explained based on the outline block diagram shown in drawing 7.

[0241] A developer 120 supports the binary system developer 128 contained by the development container 126 which contains the binary system developer 128, and the development container 126, and has the development blade 127 as a developer thickness regulation means for regulating the thickness of the developer layer formed on the development sleeve 121 as developer support for conveying to a development field, and the development sleeve 121.

[0242] The development sleeve 121 has connoted the magnet 123 in the nonmagnetic sleeve base 122.

[0243] The interior of the development container 126 is a processing laboratory (the 1st room) R1 by the septum 130. Stirring room R2 (the 2nd room) It is divided and is the stirring room R2. Up a septum 130 is separated and it is the toner stockroom R3. It is formed. Processing laboratory R1 And stirring room R2 The developer 128 is held inside and it is the toner stockroom R3. Inside, the toner 129 for supply (nonmagnetic toner) is held. in addition, toner stockroom R3 ***** — an opening 131 should be formed and pass an opening 131 — fall supply of the toner 129 for supply of the amount corresponding to the consumed toner is carried out into the stirring room R2.

[0244] Processing laboratory R1 The conveyance screw 124 is formed inside and it is a processing laboratory R1 by the rotation drive of this conveyance screw 124. The inner developer 128 is conveyed towards the longitudinal direction of the development sleeve 121. Similarly, it is a stockroom R2. The conveyance screw 125 is formed inside and it is the stirring room R2 from an opening 131 by rotation of the conveyance screw 125. The toner which fell inside is conveyed along with the longitudinal direction of the development sleeve 121.

[0245] A developer 128 is a binary system developer with a nonmagnetic toner and a magnetic carrier.

[0246] A opening is prepared in the part close to the photoconductor drum 119 of the development container 126, and the development sleeve 121 is formed outside for the gap between the projection, the development sleeve 121, and the photoconductor drum 119 from this opening. The bias impression means 132 for impressing bias to the development sleeve 121 formed in nonmagnetic material is arranged.

[0247] As mentioned above, the magnet roller 123 as a magnetic field generating means fixed to the sleeve base 122, i.e., a magnet, is the development magnetic pole S1. Magnetic pole N3 located in the lower stream of a river The magnetic pole N2 for conveying a developer 128, S2, and N1 It has. A magnet 123 is the development magnetic pole S1. It is arranged in the sleeve base 122 so that the photo conductor drum 119 may be countered. Development magnetic pole S1 A magnetic field is formed near the development section between the development sleeve 121 and a photoconductor drum 119, and a magnetic brush is formed of this magnetic field.

[0248] It is arranged above the development sleeve 121 and the developer layer regulation blade 127 which regulates the thickness of the developer 128 on the development sleeve 121 is produced by aluminum and the non-magnetic material like SUS316. 300–1000 micrometers of the edge of the nonmagnetic blade 127 and page [of a development sleeve / 121st] distance A are 400–900 micrometers preferably. If this distance A is smaller than 300 micrometers, while a magnetic carrier will tend to produce nonuniformity in during this period, i.e., a developer layer, a developer required to perform good development cannot be applied, but there is a trouble that only a development image with much nonuniformity with thin concentration is obtained. In order to prevent ununiformity spreading (the so-called blade *****) by the unnecessary particle intermingled in a developer, 400 micrometers or more are desirable. If distance A is larger than 1000 micrometers, while the amount of developers applied to up to the development sleeve 121 will increase, and predetermined developer thickness cannot be regulated but adhesion of the magnetic carrier particle to a photoconductor drum 119 will increase, developer restraining force with circulation, the nonmagnetic developer layer, and the regulation blade 127 of a developer becomes weaker, TORIBO of a toner runs short and there is a trouble of fogging-coming to be easy.

[0249] The development of this binary system developer 120 develops negatives in the magnetic brush constituted with a toner and a magnetic carrier in the condition of being in contact with the image support (for example, photo conductor drum) 119, impressing an alternating electric field. When this magnetic brush and image support contact, it is incorporated by the magnetic brush and the transfer residual toner currently supported on image support after the imprint is a processing laboratory R1. It is collected. As for the distance (distance between S–D) B of the developer support (development sleeve) 121 and the photo conductor drum 119, it is good in improvement in carrier antisticking and dot repeatability that it is 100–1000 micrometers. if supply of a developer will tend to become inadequate if narrower than 100 micrometers, image concentration becomes low and 1000 micrometers is exceeded — magnet S1 from — the force in which it is inferior to dot repeatability, or line of magnetic force restrains a carrier by the density of a breadth MAG brush becoming low becomes weaker, and it becomes easy to produce carrier adhesion.

[0250] As for the voltage between the peaks of an alternating electric field, 500–5000V are desirable, and 500–10000Hz, preferably, it is 500–3000Hz, and frequency can be suitably chosen as a process and can be used for it, respectively. In this case, it can choose from the wave which changed the triangular wave, the square wave, the sine wave, or the Duty ratio as a wave, and can use. If applied voltage is lower than 500V, sufficient image concentration is hard to be obtained, and the fogging toners of the non-image section may be unable to be collected good. When applied voltage exceeds 5000V, through a magnetic brush, an electrostatic image may be disturbed and an image quality fall may be caused.

[0251] Since fogging picking voltage (Vback) can be made low and primary electrification of a photo conductor can be lowered by using the binary system developer which has the toner charged good, the reinforcement of the photo conductor life can be carried out. Although Vback is based also on a development system, less than [100V] is more preferably good below 150V.

[0252] As contrast potential, 200V–500V are preferably used so that image concentration may come out enough.

[0253] Although it is related also to process speed if frequency is lower than 500Hz, since the charge impregnation to a carrier takes place, image quality may be reduced by disturbing carrier adhesion or a latent image. If frequency exceeds 10000Hz, a toner cannot be followed in footsteps to electric field, but it will be easy to cause an image quality fall.

[0254] In order to perform development which takes out sufficient image concentration, and is excellent in dot repeatability, and does not have carrier adhesion, it is setting preferably contact width of face (development nip C) with the photo conductor drum 119 of the magnetic brush on the development sleeve 121 to 3-8mm. If it is difficult to satisfy sufficient image concentration and dot repeatability good if the development nip C is narrower than 3mm and it is larger than 8mm, actuation of a machine will be stopped and it will become difficult for the packing of a developer to break out and to fully press down carrier adhesion. As the adjustment method of development nip, the distance A of the developer specification-part material 127 and the development sleeve 121 is adjusted, or nip width of face is suitably adjusted by adjusting the distance B of the development sleep 121 and a photoconductor drum 119.

[0255] The development method using the above-mentioned binary system developer can perform development coincidence cleaning which a developer collects in a development production process, without preparing the cleaning member which contacts the surface of a photo conductor drum between between the imprint section in an imprint production process, and the live parts in an electrification production process and a live part, and the development section in a development production process in the transfer residual toner which remains in photo conductor drum lifting after an imprint.

[0256] In the development coincidence cleaning method, to the migration direction of latent image support, it is located in order of the development section, the imprint section, and a live part, and does not have the cleaning member for removing the transfer residual toner which exists in the surface of latent-image support in contact with the surface of latent-image support between the imprint section and a live part and between a live part and the development section.

[0257] About the image formation method using a development coincidence cleaning method, it sets at a development production process. When the electrification polarity of a toner and the electrification polarity of the electrostatic latent image of latent-image support mention as an example the reversal development which develops negatives by like-pole nature, and explained it and the photo conductor of minus electrification nature and the toner of minus electrification nature are used, it sets at the imprint production process. Although the image visualized by the imprint member of plus polarity will be imprinted to imprint material, the electrification polarity of the toner of the imprint remainder is changed from plus to minus with the class (thickness, resistance, difference in a dielectric constant) of imprint material, and the relation of image area. However, by the live-part material of minus polarity at the time of the photo conductor of minus electrification nature being charged, though even the toner of the imprint remainder is swaying to plus polarity in the imprint production process with the photo conductor surface, electrification polarity can be uniformly arranged to a minus side. Even if the toner particle uniformly charged in minus polarity at the time of development exists in the photo conductor surface, when reversal development is used as the development method, so, the toner of the imprint remainder charged in minus It remains in the bright section potential section by which a toner should be developed, and all does not draw near and remain on the relation of development electric field to the umbra potential with which a toner should be developed and which does not come out in the direction of the magnetic brush of a developer, or developer support.

[0258] Next, the equipment unit of this invention is explained using drawing 6.

[0259] The main part of image formation equipment (for example, a copying machine, a laser beam printer, facsimile apparatus) is equipped with the equipment unit of this invention possible [desorption].

[0260] With the operation gestalt shown in drawing 6, an equipment unit is a developer 170 and the main part of image formation equipment is equipped with a developer 170 possible [desorption].

[0261] Therefore, what is necessary is just to have a developer 176, the development container 171, and the developer support 172 at least as an equipment unit of this invention as an equipment unit, although it has a developer 176, the development container 171, the developer support 172, a feed roller 173, the developer thickness specification-part material 174, and the churning member 175.

[0262] Furthermore as an equipment unit, you may have latent-image support, a cleaning member, or live-part material in one.

[0263] In applying the image formation method of this invention to the printer of facsimile, the light figure exposure L turns into exposure for printing received data. Drawing 11 shows an example in this case with a block diagram.

[0264] A controller 91 controls the image read station 90 and a printer 99. The whole controller 91 is controlled by CPU97. The reading data from an image read station is transmitted to a distant office through a sending circuit 93. Carrier beam data is sent to a printer 99 through a receiving circuit 92 from a distant office. Predetermined image data is memorized in an image memory. The printer controller 98 is controlling the printer 99. 94 is a telephone.

[0265] After restoring to the image (image information from the remote terminal connected through the circuit) received from the circuit 95 in a receiving circuit 92, CPU97 performs double sign processing of image information, and is stored in the image memory 96 one by one. And if at least 1-page image is stored in memory 96, image recording of the page will be performed.

CPU97 sends out the 1-page image information which read the image information of one page and was compound-ized by the printer controller 98 from memory 96. A printer controller 98 controls a printer 99 so that it may perform image information record of the page, if the 1-page image information from CPU97 is received.

[0266] In addition, CPU97 is receiving the following page during record by the printer 99.

[0267]

[Example] As mentioned above, reception and record of an image are performed.

[0268] Although an example explains this invention concretely below, this does not limit this invention at all.

[0269] To the example 1 ion-exchange-water 700 weight section, it is 0.1 M-Na₃ PO₄. After supplying the aqueous solution 450 weight section and warming at 50 degrees C, it agitated in 10,000rpm using TK type homomixer (product made from special opportunity-ized industry). They are 1.0 M-CaCl₂ to this. The aqueous solution 70 weight section was added gradually, and basin system data medium containing a calcium phosphate salt was obtained.

Styrene (Monomer) The 170 weight sections n-butyl acrylate The 30 weight sections (coloring agent) C.I. pigment blue 15:3 15 weight sections (electric charge control agent) salicylic-acid metallic compounds Two weight sections (polar resin) saturated polyester 20 weight sections (oxidation 10, peak molecular weight; 15,000)

(Release agent) Behenyl stearate 30 weight sections (cross linking agent) divinylbenzene The 0.5 weight sections [0270] The above-mentioned formula was warmed at 50 degrees C, TK type homomixer (product made from special opportunity-ized industry) was used, and it dissolved and distributed to homogeneity in 9000rpm. A polymerization initiator 2 and the 2'-azobis (2,4-dimethylvaleronitrile) 5 weight section were dissolved in this, and the polymerization nature monomer constituent was prepared.

[0271] The above-mentioned polymerization nature monomer constituent is thrown in in said basin system data medium, and it is 50 degrees C and N₂. It agitated by 8000rpm by TK type homomixer under the ambient atmosphere, and the polymerization nature monomer constituent was corned.

[0272] Then, agitating by the paddle impeller, a temperature up is carried out to 60 degrees C in 2 hours, and the temperature up was carried out to 70 degrees C, and it was made to react by the programming rate of 40 degrees C / Hr. 4 hours after for 5 hours. The residual monomer was distilled off under reduced pressure after polymerization reaction termination, after cooling, the hydrochloric acid was added, the calcium phosphate salt was dissolved, and the suspension containing a cyanogen toner particle (1-a) was obtained.

[0273] When circularity distribution and particle size distribution were measured for the obtained cyanogen toner particle (1-a) using the flow type particle image measuring device by TOA Medical Electronics Co., Ltd., it is average circularity 0.970, had the maximal value X in 6.1 micrometers of projected area diameters, and did not have the maximal value Y in the range of 0.60-micrometer or more less than 2.00-micrometer projected area diameter. The content of a 0.60-micrometer or more projected area diameter [less than 2.00 micrometer] particle was

several 4%.

[0274] On the other hand, having added the persulfuric acid calcium 3 weight section to the ion-exchange-water 500 weight section as the styrene monomer 7 weight section and a water-soluble initiator, and agitating by the paddle impeller, the temperature up was carried out to 70 degrees C, the soap free polymerization was performed for 24 hours, and the suspension containing a particle polymer (1-b) was obtained.

[0275] When circularity distribution and particle size distribution were measured for the obtained particle polymer (1-b) using the flow type particle image measuring device by TOA Medical Electronics Co., Ltd., it was average circularity 0.972, and it had the maximal value only in 0.8 micrometers of projected area diameters, and the content of a 0.60-micrometer or more projected area diameter [less than 2.00 micrometer] particle was several 72%.

[0276] After agitating the suspension containing a particle polymer (1-b) by the paddle impeller at whole-quantity **** and a room temperature to the suspension containing a cyanogen toner particle (1-a) for 2 hours, filtration, rinsing, and desiccation were carried out and the cyanogen toner particle (1) with a weighted mean particle size of 6.5 micrometers was obtained.

[0277] The BET specific surface area which carried out silicone oil surface treatment the silica impalpable powder (A-1) of 110m² / g to this cyanogen toner particle (1) 100 weight section The 1.0 weight section, The BET specific surface area which carried out surface treatment by silicone oil and the coupling agent the silica impalpable powder (B-1) of 50m² / g After 0.5 weight *****, Using the Henschel mixer by Mitsui Mining Co., Ltd., it agitated to homogeneity, the cyanogen toner (1) was obtained, and this was made into the nonmagnetic one component system developer (1).

[0278] To the commercial silica pulverized coal NAX50 (product made from Japanese Aerosil) 100 weight section, the above-mentioned silica impalpable powder (B-1) performs surface treatment in the dimethyl silicone oil 10 weight section, performs pneumatic elutriation, extracts a particle coarse in comparison, and adjusts particle size distribution. the 100,000 times as many enlargement according [this silica impalpable powder (B-1)] to a transmission electron microscope (TEM) as this, and the 100,000 times as many enlargement by the scanning electron microscope (SEM) as this — setting — an average of 1 — it was checked that it is the particle with which two or more primary particles of order particle-size 40mmum were united. The particle shape of the silica impalpable powder (B-1) checked from this enlargement is shown in drawing 10 .

[0279] In the enlargement by the scanning electron microscope of a cyanogen toner (1), shape factor SF-1 (100,000 times as many enlargement as this) of the primary particle of the silica impalpable powder (A-1) which exists on a toner particle was 117, and shape factor SF-1 (50,000 times as many enlargement as this) of the silica impalpable powder (B-1) which exists on a toner particle similarly was 290.

[0280] Furthermore, in the 500,000 times as many enlargement by the scanning electron microscope of a cyanogen toner (1) as this, individual number average major axes are 7.35mmum, and, as for the primary particle of silica impalpable powder (A-1), it was checked that 122 the major axis / minor axes per 0.5micrometerx0.5micrometer area are 1.1, and exist in a 100,000 times as many enlargement as this. In the 50,000 times as many enlargement by the scanning electron microscope of a cyanogen toner (1) as this, individual number average major axes are 152mmum, and, as for silica impalpable powder (B-1), it was checked that six the major axis / minor axes per area which are 3.2 and are 1.0micrometerx1.0micrometers exist.

[0281] Furthermore, in the 100,000 times as many enlargement by the scanning electron microscope of a cyanogen toner (1) as this, the average (the average Ferre minimum width of face) of the Ferre minimum width of face of the primary particle which constitutes silica impalpable powder (B-1) was 42mmum.

[0282] When circularity distribution and particle size distribution were measured for the cyanogen toner (1) using the flow type particle image measuring device by TOA Medical Electronics Co., Ltd., it was average circularity 0.970, and it had the maximal value X in 6.1 micrometers of projected area diameters, and had the maximal value Y in 0.8 micrometers of projected area diameters, and the content of a 0.60-micrometer or more projected area diameter

[less than 2.00 micrometer] particle was several 24%.

[0283] It evaluated by performing 5000 sheet copy paper about each evaluation criteria using the reconstruction machine which converted Canon LBP-2030 of marketing for the obtained developer as drawing 1 showed.

[0284] As a developer as the reconstruction machine of LBP-2030 is shown in drawing 1 as black development counter 4Bk and yellow development counter 4Y, Magenta development counter 4M, and cyanogen development counter 4C The rotary unit 4 which equipped with the developer 170 of a nonmagnetic one component system development method using the nonmagnetic one component system developer shown in drawing 6 respectively possible [desorption] is used. After imprinting secondarily the multiplex toner image by each color toner primarily imprinted on the middle imprint drum 5 to a package at the record material P, it is the configuration which carries out heating fixing, and a fixing assembly 9 is also further converted into the following configurations at the record material P.

[0285] Fixing roller 9a of a fixing assembly 9 used what covered the shaft of aluminum in two sorts of layers. Elevated-temperature vulcanization silicone rubber (HTV silicone rubber) was used for the lower layer section as an elastic layer. The thickness of an elastic layer was 2.1mm and the rubber degree of hardness was 3 degrees (JIS-A). What thin-film-ized the tetrafluoroethylene-perfluoro-alkyl vinyl ether copolymer (PFA) with the spray coat as a mold release layer was used for the management. The thickness of a thin film was 20 micrometers.

[0286] Pressurization roller 9b of a fixing assembly 9 as well as fixing roller 9a used what is wrap structure in a lower layer silicone rubber elastic layer and the upper fluororesin type layer, and consists a shaft top of an equivalent material, thickness, and a physical-properties value.

[0287] Nip width of face of the fixing section was set to 9.5mm, ***** set to 2.00×10^5 Pa, and the fixing roller skin temperature at the time of standby was set as 180 degrees C. The spreading device of fixing oil was removed.

[0288] The middle imprint drum 5 used for the surface of an aluminum cylinder what covered the mixture of NBR and epichlorohydrin rubber with 5mm in thickness as an elastic layer.

[0289] Cyanogen development counter 4C of the above-mentioned reconstruction machine of LBP-2030 was filled up with the 160g (1) of the above-mentioned nonmagnetic one component system developers, commercial CLC paper A4 (the CANON SALES CO., INC. sale and *****81.4 g/m²) was set to the tray 7 as record material P, and the continuation ***** test was performed on condition that the following.

[0290] - primary electrification condition: — the direct current voltage of -600V and the electrification bias voltage on which the alternating voltage of amplitude 2kVpp was made to superimpose by the 1150Hz sine wave were impressed to the electrification roller 2 from the power supply which is not a drawing example. By impressing voltage to the electrification roller 2, the charge was moved by discharge to the photoconductor drum 1 of an insulating material, and it was charged uniformly.

[0291] - Latent-image formation conditions : on the photoconductor drum 1 charged uniformly, exposure exposure of the laser beam E was carried out, and the electrostatic latent image was formed. The surface potential of the exposed portion set up laser beam reinforcement so that it might be set to -200V.

[0292] - Development conditions : the direct current voltage of -350V and the development bias voltage on which the alternating voltage of amplitude 1.8kVpp was made to superimpose by the 2300Hz sine wave were made to impress to the cyanogen development counter of 4C in drawing 1, the alternating electric field was formed between (300 micrometers of gaps) the development sleeve and the photoconductor drum 1, and negatives were developed by making the toner on a development sleeve (170 micrometers of toner thickness) fly.

[0293] - Primary imprint conditions : in order to imprint primarily the toner image formed of development counter 4C on the photoconductor drum 1 on the middle imprint object 5, the direct current voltage of +300V was impressed to drum 5 made from aluminum as a primary imprint bias voltage.

[0294] - Secondary imprint conditions : in order to imprint secondarily the toner image primarily imprinted on the middle imprint object 5 to the record material P, the direct current voltage of

+2000V was impressed to the imprint means 8 as secondary imprint bias.

[0295] Evaluation went as follows about the image concentration in each first stage and durable number of sheets and the image concentration stability of a solid image, the early amount of fogging in the paper, and the **** repeatability in each durable number of sheets.

[0296] The image concentration of ten places which printed one solid image concentration all image, and chose it from all the obtained solid images at random was measured using the reflective formality meter (TOKYO DENSHOKU CO., LTD company make REFLECTOMETER ODEL TC-6DS).

[0297] This was performed 3 times, the image concentration of a total of 30 places was measured, and the arithmetic mean of the acquired numeric value was made into the concentration of an initial image.

[0298] Printing number of sheets evaluated image concentration in each durable number of sheets by the same method using the evaluation method of the above-mentioned publication also with 1000 per hour, 3000 per hour, and 5000-sheet the image it is [image] o'clock.

[0299] The image concentration of ten places which printed all one solid image and chose it from all the obtained solid images at random in the environment of the image concentration stability temperature of 20 degrees C of a solid image and 30% of humidity was measured using the reflective formality meter (TOKYO DENSHOKU CO., REFLECTOMETER ODEL TC-6DS made from LTD).

[0300] This was performed 3 times, the image concentration of a total of 30 places was measured, the acquired difference of numerical maximum and the minimum value was calculated, and the degree was written as follows.

a: the difference of maximum and the minimum value — less than [0.2] b: — the difference of maximum and the minimum value — less than [0.2 super-0.4] c: — the difference of maximum and the minimum value — less than [0.4 super-0.6] d: — the difference of maximum and the minimum value — less than [0.6 super-0.8] e: — the difference of maximum and the minimum value — 0.8 ** [0301] In the above-mentioned evaluation, it is the good image which has neither a blur nor nonuniformity in an initial image, and was excellent in image concentration stability, so that the difference of maximum and the minimum value is small.

[0302] Image concentration stability of the solid image in each durable number of sheets was evaluated by the same method also with the image whose printing number of sheets is 1000-sheet o'clock and 3000-sheet o'clock and 5000-sheet o'clock about the above-mentioned evaluation.

[0303] The image which has the solid white image section using commercial CLC paper A4 (the CANON SALES CO., INC. sale and ****:81.4 g/m²) as amount record material of fogging in the paper was printed, and the reflection density of the solid white section after a print and the reflection density of the form before a print were measured using the reflective formality meter (TOKYO DENSHOKU CO., REFLECTOMETER ODEL TC-6DS made from LTD).

[0304] The difference (Ds-Dr) of the white section reflection density worst value after a print (Ds) and the reflection density average value (Dr) of the form before a print was made into the amount of fogging in the paper.

[0305] The 2% or less of the amounts of fogging in the paper is the good image which does not have fogging in the paper substantially, and when it exceeds 5%, they are an indistinct image with which fogging in the paper is conspicuous.

At the time of a:5000-sheet print termination, it is the less than 5% of the amounts of fogging in the paper at the time of 2% or less termination [b:3000 sheet print] of the amounts of fogging in the paper. At the time of 5000-sheet print termination, it is the less than 5% of the amounts of fogging in the paper at the time of 5% or more termination [c:1000 sheet print] of the amounts of fogging in the paper. At the time of 3000-sheet print termination, it is the less than 5% of the amounts of fogging in the paper at the time of 5% or more termination [d:500 sheet print] of the amounts of fogging in the paper, and is the 5% or more of the amounts of fogging in the paper

[0306] at the time of 5% or more termination [e:500 sheet print] of the amounts of fogging in the paper at the time of 1000-sheet print termination. Evaluation of thin line repeatability thin line repeatability formed the latent-image image of the shape of stripes as shown in drawing 9 , and evaluated about the image after fixing.

[0307] Latent-image **** [in / in drawing 9 / resolution 600dpi] is 4 dots (170 micrometers), and non-latent-image **** is the latent-image image of 10 dots (420 micrometers).

[0308] 1,000 striped latent-image images of the above were formed continuously, five points were chosen from the image section at random using the fixing image of the 1,000th sheet, and the average of image **** of five points and the absolute value of a difference with theoretical latent-image **** (170 micrometers) estimated.

a:0-micrometer or more 30-micrometer or less ** [90 micrometers or less d:90 60 micrometers or less c:60 b:30 micrometer super-micrometer super-micrometer] [0309] Printing number of sheets performed the above-mentioned evaluation also about the 3000-sheet o'clock and 5000-sheet image it is [image] o'clock.

[0310] The various physical properties of a toner are shown in a table 2, and an evaluation result is shown in a table 4.

[0311] It replaced with the silica impalpable powder (B-1) 0.5 weight section used in the example 2 example 1, the cyanogen toner (2) which has the various physical properties which show it in a table 2 like an example 1 if it removes that the BET specific surface area which has not carried out surface treatment uses the silica impalpable powder (B-2) 0.4 weight section of 81m² / g was obtained, and this was made into the nonmagnetic one component system developer (2).

[0312] It evaluated like the example 1 using this nonmagnetic one component system developer (2).

[0313] An evaluation result is shown in a table 4.

[0314] It replaces with the silica impalpable powder (A-1) 1.0 weight section and the silica impalpable powder (B-1) 0.5 weight section which were used in the example 3 example 1. If it removes that the BET specific surface area to which the BET specific surface area which carried out surface treatment by silicone oil carried out surface treatment by the alumina impalpable powder (A-2) 1.0 weight section and silicone oil of 145m² / g uses the silica impalpable powder (B-3) 0.6 weight section of 70m² / g The cyanogen toner (3) which has the various physical properties shown in a table 2 like an example 1 was obtained, and this was made into the nonmagnetic one component system developer (3).

[0315] It evaluated like the example 1 using this nonmagnetic one component system developer (3).

[0316] An evaluation result is shown in a table 4.

[0317] It replaced with the silica impalpable powder (B-1) 0.5 weight section used in the example 4 example 1, the cyanogen toner (4) which has the various physical properties which show it in a table 2 like an example 1 if it removes that the BET specific surface area which carried out surface treatment in the order of hexamethyldisilazane and dimethyl silicone oil uses the silica impalpable powder (B-4) 0.6 weight section of 73m² / g was obtained, and this was made into the nonmagnetic one component system developer (4).

[0318] It evaluated like the example 1 using this nonmagnetic one component system developer (4).

[0319] An evaluation result is shown in a table 4.

[0320] It replaces with the silica impalpable powder (A-1) 1.0 weight section and the silica impalpable powder (B-1) 0.5 weight section which were used in the example 5 example 1. Surface treatment If it removes that the BET specific surface area to which the BET specific surface area which has not been carried out carried out surface treatment in the order of the silica impalpable powder (A-3) 0.8 weight section of 141m² / g, hexamethyldisilazane, and dimethyl silicone oil uses the silica impalpable powder (B-5) 0.6 weight section of 60m² / g The cyanogen toner (5) which has the various physical properties shown in a table 2 like an example 1 was obtained, and this was made into the nonmagnetic one component system developer (5).

[0321] It evaluated like the example 1 using this nonmagnetic one component system developer (5).

[0322] An evaluation result is shown in a table 4.

[0323] It replaced with the silica impalpable powder (B-1) 0.5 weight section used in the example 6 example 1, the cyanogen toner (6) which has the various physical properties which show it in a table 2 like an example 1 if it removes that the BET specific surface area which has not carried

out surface treatment uses the titanium oxide impalpable powder (B-6) 0.6 weight section of 86m² / g was obtained, and this was made into the nonmagnetic one component system developer (6).

[0324] It evaluated like the example 1 using this nonmagnetic one component system developer (6).

[0325] An evaluation result is shown in a table 4.

[0326] It replaces with the silica impalpable powder (A-1) 1.0 weight section and the silica impalpable powder (B-1) 0.5 weight section which were used in the example 7 example 1. If it removes that the BET specific surface area which carried out surface treatment by the silica impalpable powder (A-1) 1.3 weight section and silicone oil uses the silica impalpable powder (B-7) 0.6 weight section of 60m² / g The cyanogen toner (7) which has the various physical properties shown in a table 2 like an example 1 was obtained, and this was made into the nonmagnetic one component system developer (7).

[0327] It evaluated like the example 1 using this nonmagnetic one component system developer (7).

[0328] An evaluation result is shown in a table 4.

[0329] It replaces with the silica impalpable powder (A-1) 1.0 weight section and the silica impalpable powder (B-1) 0.5 weight section which were used in the example 8 example 1. The cyanogen toner (8) which has the various physical properties which show it in a table 2 like an example 1 if it removes using the silica impalpable powder (A-1) 4.0 weight section and the silica impalpable powder (B-1) 0.5 weight section was obtained, and this was made into the nonmagnetic one component system developer (8).

[0330] It evaluated like the example 1 using this nonmagnetic one component system developer (8).

[0331] An evaluation result is shown in a table 4.

[0332] It replaces with the silica impalpable powder (A-1) 1.0 weight section and the silica impalpable powder (B-1) 0.5 weight section which were used in the example 9 example 1. The cyanogen toner (9) which has the various physical properties which show it in a table 2 like an example 1 if it removes using the silica impalpable powder (A-1) 0.7 weight section and the silica impalpable powder (B-1) 3.6 weight section was obtained, and this was made into the nonmagnetic one component system developer (9).

[0333] It evaluated like the example 1 using this nonmagnetic one component system developer (9).

[0334] An evaluation result is shown in a table 4.

[0335] It replaces with the silica impalpable powder (A-1) 1.0 weight section and the silica impalpable powder (B-1) 0.5 weight section which were used in the example 10 example 1. The cyanogen toner (10) which has the various physical properties which show it in a table 2 like an example 1 if it removes using the silica impalpable powder (A-1) 2.4 weight section and the silica impalpable powder (B-1) 1.7 weight section was obtained, and this was made into the nonmagnetic one component system developer (10).

[0336] It evaluated like the example 1 using this nonmagnetic one component system developer (10).

[0337] An evaluation result is shown in a table 4.

[0338] To the example 11 ion-exchange-water 700 weight section, it is 0.1 M-Na₃ PO₄. After supplying the aqueous solution 450 weight section and warming at 50 degrees C, it agitated in 10,000rpm using TK type homomixer (product made from special opportunity-ized industry). They are 1.0 M-CaCl₂ to this. The aqueous solution 70 weight section was added gradually, and basin system data medium containing a calcium phosphate salt was obtained.

Styrene (Monomer) The 175 weight sections n-butyl acrylate The 25 weight sections (coloring agent) C.I. pigment blue 15:3 15 weight sections (electric charge control agent) BONTORON E-84 (product made from the ORIENT chemistry) Three weight sections (polar resin) saturated polyester 20 weight sections (oxidation 10, peak molecular weight; 15,000)

(Release agent) Behenyl stearate 30 weight sections (cross linking agent) divinylbenzene The 1.5 weight sections [0339] The above-mentioned formula was warmed at 50 degrees C, TK type

homomixer (product made from special opportunity-ized industry) was used, and it dissolved and distributed to homogeneity in 9000rpm. A polymerization initiator 2 and the 2'-azobis (2,4-dimethylvaleronitrile) 5 weight section were dissolved in this, and the polymerization nature monomer constituent was prepared.

[0340] The above-mentioned polymerization nature monomer constituent is thrown in in said basin system data medium, and it is 50 degrees C and N₂. It agitated by 8500rpm by TK type homomixer under the ambient atmosphere, and the polymerization nature monomer constituent was corned.

[0341] Then, agitating by the paddle impeller, a temperature up is carried out to 60 degrees C in 2 hours, and the temperature up was carried out to 70 degrees C, and it was made to react by the programming rate of 40 degrees C / Hr. 4 hours after for 5 hours. The residual monomer was distilled off under reduced pressure after polymerization reaction termination, after cooling, after adding the hydrochloric acid and dissolving a calcium phosphate salt, filtration, rinsing, and desiccation were carried out and the cyanogen toner particle (2-a) with a weighted mean particle size of 6.5 micrometers was obtained.

[0342] When circularity distribution and particle size distribution were measured for the cyanogen toner particle (2-a) using the flow type particle image measuring device by TOA Medical Electronics Co., Ltd., it was average circularity 0.973, and it had the maximal value X in 1.0 micrometers of projected area diameters, and had the maximal value Y in 6.9 micrometers of projected area diameters, and the content of a 0.60-micrometer or more projected area diameter [less than 2.00 micrometer] particle was several 41%.

[0343] Pneumatic elutriation was performed for this cyanogen toner particle (2-a), the comparatively fine particle was removed, and the cyanogen toner particle (2) was obtained.

[0344] After adding the silica impalpable powder (A-1) 1.0 weight section and the silica impalpable powder (B-1) 0.5 weight section like an example 1 to this cyanogen toner particle (2) 100 weight section, the cyanogen toner (11) which has the various physical properties which agitate to homogeneity and are shown in a table 2 was obtained using the Henschel mixer by Mitsui Mining Co., Ltd., and this was made into the nonmagnetic one component system developer (11).

[0345] When circularity distribution and particle size distribution were measured for the cyanogen toner (11) using the flow type particle image measuring device by TOA Medical Electronics Co., Ltd., it was average circularity 0.970, and it had the maximal value X in 1.0 micrometers of projected area diameters, and had the maximal value Y in 6.5 micrometers of projected area diameters, and the content of a 0.60-micrometer or more projected area diameter [less than 2.00 micrometer] particle was several 18%.

[0346] It evaluated like the example 1 using this nonmagnetic 1 component developer (11).

[0347] An evaluation result is shown in a table 4.

[0348] After supplying the water 180 weight section and the 0.2-% of the weight aqueous solution 20 weight section of polyvinyl alcohol which carried out the nitrogen purge to the example of comparison 1 4 opening flask, the styrene 75 weight section, the acrylic-acid-n-butyl 25 weight section, the benzoyl peroxide 3.0 weight section, and the divinylbenzene 0.01 weight section were added and agitated, and it considered as suspension. Then, after nitrogen replaced the inside of a flask, the temperature up was carried out to 80 degrees C, it held to this temperature for 10 hours, and the polymerization reaction was performed.

[0349] After rinsing this polymer, keeping temperature at 65 degrees C, it dried in reduced pressure environment and resin was obtained. The obtained resin was mixed by 88 weight sections, 12 weight sections and the paraffin wax 10 weight section were mixed [metal-containing azo dye] for 4 weight sections and the C.I. pigment blue 15:3 with the fixed tub type dry-blending machine, and the 2 shaft extruder performed melting kneading, having connected with the suction pump and attracting a vent-port.

[0350] Crushing of this melting kneading object was carried out with the hammer mill, and the crushing object of the toner constituent of 1mm mesh pass was obtained. Furthermore, the jet mill using the collision between particles in a revolution style ground, after the mechanical-cable-type grinder ground this crushing object to the volume mean diameter of 20-30

micrometers, in the surface treatment machine, the toner constituent was reformed according to thermal and mechanical shearing force, with the multistage rate classifier, the classification was performed and the cyanogen toner particle (3) with a weighted mean particle size of 7.0 micrometers was obtained.

[0351] After adding the silica impalpable powder (A-1) 1.0 weight section and the silica impalpable powder (B-1) 0.5 weight section like an example 1 to the obtained cyanogen toner particle (3) 100 weight section, the cyanogen toner (12) which has the various physical properties which agitate to homogeneity and are shown in a table 3 was obtained using the Henschel mixer by Mitsui Mining Co., Ltd., and this was made into the nonmagnetic one component system developer (12).

[0352] It evaluated like the example 1 using this nonmagnetic one component system developer (12).

[0353] An evaluation result is shown in a table 4.

[0354] the silica impalpable powder (A-1) 1.0 weight section and the silica impalpable powder (B-1) 0.5 weight section which were used in the example of comparison 2 example 1 — replacing with — silica impalpable powder (B-1) — **** for the 0.8 weight sections — if things were removed, the cyanogen toner (13) which has the various physical properties shown in a table 3 like an example 1 was obtained, and this was made into the nonmagnetic one component system developer (13).

[0355] It evaluated like the example 1 using this nonmagnetic one component system developer (13).

[0356] An evaluation result is shown in a table 4.

[0357] the silica impalpable powder (A-1) 1.0 weight section and the silica impalpable powder (B-1) 0.5 weight section which were used in the example of comparison 3 example 1 — replacing with — silica impalpable powder (A-1) — **** for the 1.4 weight sections — if things were removed, the cyanogen toner (14) which has the various physical properties shown in a table 3 like an example 1 was obtained, and this was made into the nonmagnetic one component system developer (14).

[0358] It evaluated like the example 1 using this nonmagnetic one component system developer (14).

[0359] An evaluation result is shown in a table 4.

[0360] It replaced with the silica impalpable powder (B-1) 0.5 weight section used in the example of comparison 4 example 1, the cyanogen toner (15) which has the various physical properties which show it in a table 3 like an example 1 if it removes that the BET specific surface area which carried out surface treatment in the order of hexamethyldisilazane and dimethyl silicone oil uses the silica impalpable powder (B-10) 0.5 weight section of 38m² / g was obtained, and this was made into the nonmagnetic one component system developer (15).

[0361] It evaluated like the example 1 using this nonmagnetic one component system developer (15).

[0362] An evaluation result is shown in a table 4.

[0363] Not using each of silica impalpable powder (A-1) used in the example of comparison 5 example 1, and silica impalpable powder (B-1), the cyanogen toner (16) which has the various physical properties shown in a table 3, using a cyanogen toner particle (1) as it is was obtained, and this was made into the nonmagnetic one component system developer (16).

[0364] When evaluated like the example 1 using this nonmagnetic one component system developer (16), scattering of a toner inside the plane arose notably, and since it was a bad remarkable result, also in which evaluation criteria of o'clock of first stage and 1000-sheet image concentration, both the images stability of a solid image, the amount of fogging in the paper, and thin line repeatability, evaluation was further stopped by 1000-sheet o'clock.

[0365] An evaluation result is shown in a table 4.

[0366] In example of comparison 6 example 1, in the manufacture conditions of a cyanogen toner particle (1), filtration, rinsing, and desiccation were carried out only for the suspension containing a cyanogen toner particle (1-a), without using the suspension containing a particle polymer (1-b), and the cyanogen toner particle (4) was obtained like the example 1.

[0367] After adding the silica impalpable powder (A-1) 1.0 weight section and the silica impalpable powder (B-1) 0.5 weight section like an example 1 to the obtained cyanogen toner particle (4) 100 weight section, the cyanogen toner (17) which has the various physical properties which agitate to homogeneity and are shown in a table 3 was obtained using the Henschel mixer by Mitsui Mining Co., Ltd., and this was made into the nonmagnetic one component system developer (17).

[0368] It evaluated like the example 1 using this nonmagnetic one component system developer (17).

[0369] An evaluation result is shown in a table 4.

[0370]

Example of comparison 7 (monomer) styrene monomer Seven weight sections Divinylbenzene 0.2 weight sections (initiator) potassium persulfate Four weight sections [0371] The temperature up was carried out to 60 degrees C, the soap free polymerization was performed for 72 hours, having added the above-mentioned raw material into the ion-exchange-water 500 weight section, and agitating by the paddle impeller, and the suspension containing a particle polymer (5-b) was obtained.

[0372] When circularity distribution and particle size distribution were measured for the particle polymer (5-b) using the flow type particle image measuring device by TOA Medical Electronics Co., Ltd., it was average circularity 0.972, and it had the maximal value only in 2.6 micrometers of projected area diameters, and the content of a 0.60-micrometer or more projected area diameter [less than 2.00 micrometer] particle was several 37%.

[0373] If it removed carrying out whole-quantity addition of the particle polymer (5-b) into the suspension containing a cyanogen toner particle (1-a) instead of the particle polymer (1-b) used in the example 1, the cyanogen toner particle (5) was obtained like the example 1.

[0374] After adding the silica impalpable powder (A-1) 1.0 weight section and the silica impalpable powder (B-1) 0.5 weight section like an example 1 to the obtained cyanogen toner particle (5) 100 weight section, the cyanogen toner (18) which has the various physical properties which agitate to homogeneity and are shown in a table 3 was obtained using the Henschel mixer by Mitsui Mining Co., Ltd., and this was made into the nonmagnetic one component system developer (18).

[0375] It evaluated like the example 1 using this nonmagnetic one component system developer (18).

[0376] An evaluation result is shown in a table 4.

[0377] It replaces with the silica impalpable powder (B-1) 0.5 weight section used in the example of comparison 8 example 1. if it removes that the BET specific surface area which changed so that the classification conditions of silica impalpable powder (B-1) might be boiled comparatively and a fine particle might be extracted, and adjusted particle size distribution uses the silica impalpable powder (B-8) 0.5 weight section of 110m² / g The cyanogen toner (19) which has the various physical properties shown in a table 3 like an example 1 was obtained, and this was made into the nonmagnetic one component system developer (19).

[0378] It evaluated like the example 1 using this nonmagnetic one component system developer (19).

[0379] An evaluation result is shown in a table 4.

[0380] It replaces with the silica ***** (B-1) 0.5 weight section used in the example of comparison 9 example 1. If it removes that the BET specific surface area which changed so that classification actuation might be repeated, and prepared particle size distribution uses the silica impalpable powder (B-9) 0.5 weight section of 22m² / g so that only a coarser particle can be extracted for the classification conditions of silica impalpable powder (B-1) The cyanogen toner (20) which has the various physical properties shown in a table 3 like an example 1 was obtained, and this was made into the nonmagnetic one component system developer (20).

[0381] It evaluated like the example 1 using this nonmagnetic one component system developer (20).

[0382] An evaluation result is shown in a table 4.

[0383]

[A table 2]

トナー	トナー				トナー粒子 No	外添剤															
	平均円形度	粒度分布				無機微粉体 (A)								無機微粉体 (B)							
		極大値 X (μm)	極大値 Y (μm)	未測の粒子の含有量 (割合%)		種類	含有量 (重量部)	BET比表面積 (㎡/g)	トナーの走査型顕微鏡による拡大写真におけるトナー粒子上に存在する外添剤の物性				種類	含有量 (重量部)	BET比表面積 (㎡/g)	トナーの走査型顕微鏡による拡大写真におけるトナー粒子上に存在する外添剤の物性					
									形状係数 S _F -1	長径/短径	平均長径 (nm)	当りの存在個数				形状係数 S _F -1	長径/短径	平均長径 (nm)	当りの存在個数		
シアトル (1)	0.970	6.1	0.8	24	シアトル粒子 (1)	0.1	110	117	1.1	7.4	122	シアトル粉末 (B-1)	0.5	50	290	3.2	152	6	42		
シアトル (2)	0.970	6.1	0.9	23	シアトル粒子 (1)	0.1	110	115	1.1	7.4	119	シアトル粉末 (B-2)	0.4	81	209	3.8	412	7	38		
シアトル (3)	0.969	6.0	0.8	28	シアトル粒子 (1)	0.1	145	123	1.4	17.5	61	シアトル粉末 (B-3)	0.5	70	281	3.3	245	7	41		
シアトル (4)	0.970	6.0	0.9	18	シアトル粒子 (1)	0.1	110	121	1.1	7.4	98	シアトル粉末 (B-4)	0.5	73	221	2.3	70	12	27		
シアトル (5)	0.976	6.1	0.9	25	シアトル粒子 (1)	0.8	141	119	1.2	6.6	131	シアトル粉末 (B-5)	0.6	60	250	3.1	197	15	51		
シアトル (6)	0.975	6.1	0.9	29	シアトル粒子 (1)	1.0	110	117	1.1	7.4	125	酸化チタン粉末 (B-6)	0.8	86	236	2.9	46	4	28		
シアトル (7)	0.977	6.1	0.9	38	シアトル粒子 (1)	1.3	110	120	1.1	7.4	210	シアトル粉末 (B-7)	0.6	38	202	2.1	271	9	60		
シアトル (8)	0.975	6.1	0.8	22	シアトル粒子 (1)	4.0	110	122	1.1	7.4	310	シアトル粉末 (B-1)	0.5	50	286	3.2	152	7	40		
シアトル (9)	0.978	6.1	0.8	28	シアトル粒子 (1)	0.7	110	128	1.1	7.4	84	シアトル粉末 (B-1)	3.8	50	278	3.2	152	21	41		
シアトル (10)	0.971	6.1	0.9	26	シアトル粒子 (1)	2.4	110	120	1.1	7.4	257	シアトル粉末 (B-1)	1.7	50	311	3.2	152	19	44		
シアトル (11)	0.970	6.5	1.0	18	シアトル粒子 (2)	1.0	110	119	1.1	7.3	121	シアトル粉末 (B-1)	0.5	50	292	3.2	155	8	43		
メソライト (21)	0.968	6.3	0.9	24	メソライト粒子 (6)	1.0	110	116	1.1	7.4	126	シアトル粉末 (B-1)	0.5	50	291	3.2	152	8	43		
メソライト (22)	0.972	6.2	0.9	22	メソライト粒子 (7)	1.0	110	113	1.1	7.4	118	シアトル粉末 (B-1)	0.5	50	258	3.2	154	11	39		
フラット (23)	0.970	6.0	0.9	23	フラット粒子 (8)	1.0	110	116	1.1	7.4	121	シアトル粉末 (B-1)	0.5	50	279	3.2	154	9	41		

[0384]

[A table 3]

トナー	トナー				トナー粒子 No	外添剤													
	平均円形度	粒度分布				無機微粉体 (A)						無機微粉体 (B)							
		極大値 X (μm)	極大値 Y (μm)	未調の粒子の含有量 (個数%)		種類	含有量 (重量部)	BET比表面積 (㎡/g)	トナーの走査型顕微鏡による拡大写真におけるトナー粒子上に存在する外添剤の物性			種類	含有量 (重量部)	BET比表面積 (㎡/g)	トナーの走査型顕微鏡による拡大写真におけるトナー粒子上に存在する外添剤の物性				
									形状係数 S _F -1	長径/短径	平均長径 (nm)				0.6×0.6の面積当りの存在個数	形状係数 S _F -1	長径/短径	平均長径 (nm)	1.0×1.0の面積当りの存在個数
シアトル (12)	0.935	6.0	1.2	45	シアトル粉末 (A-1)	1.0	110	120	1.1	7.4	128	シアトル粉末 (B-1)	0.5	50	288	3.2	152	9	41
シアトル (13)	0.965	6.0	0.8	26	-	-	-	-	-	-	-	シアトル粉末 (B-1)	0.8	50	271	3.2	152	11	43
シアトル (14)	0.968	6.1	0.8	20	シアトル粉末 (A-1)	1.4	110	120	1.1	7.4	211	-	-	-	-	-	-	-	-
シアトル (15)	0.964	6.5	0.9	28	シアトル粉末 (A-1)	1.0	110	118	1.1	7.4	131	シアトル粉末 (B-10)	0.5	38	138	1.3	200	9	41
シアトル (16)	0.970	6.0	0.9	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
シアトル (17)	0.970	6.1	-	4	シアトル粉末 (A-1)	1.0	110	130	1.1	7.4	130	シアトル粉末 (B-1)	0.5	50	273	3.2	152	6	44
シアトル (18)	0.968	6.5	2.6	11	シアトル粉末 (A-1)	1.0	110	123	1.1	7.4	129	シアトル粉末 (B-1)	0.5	50	281	3.2	152	12	45
シアトル (19)	0.971	6.1	0.9	23	シアトル粉末 (A-1)	1.0	110	114	1.1	7.4	118	シアトル粉末 (B-1)	0.5	110	261	3.2	152	80	27
シアトル (20)	0.970	6.1	0.9	28	シアトル粉末 (A-1)	1.0	110	120	1.1	7.4	121	シアトル粉末 (B-1)	0.5	22	287	3.2	152	2	283

[0385]

[A table 4]

	トナー No.	画像濃度				ベタ画像濃度安定性				紙上 カブリ量	細線再現性		
		初期	1000枚時	3000枚時	5000枚時	初期	1000枚時	3000枚時	5000枚時		1000枚時	3000枚時	5000枚時
実施例1	シフトナー(1)	1.50	1.50	1.50	1.50	a	a	a	a	a	a	a	a
実施例2	シフトナー(2)	1.50	1.50	1.49	1.49	a	a	b	b	b	a	a	b
実施例3	シフトナー(3)	1.50	1.48	1.50	1.49	a	a	a	b	a	a	a	b
実施例4	シフトナー(4)	1.50	1.49	1.50	1.47	a	a	b	b	b	a	b	b
実施例5	シフトナー(5)	1.50	1.50	1.50	1.46	a	a	a	b	b	a	a	b
実施例6	シフトナー(6)	1.50	1.47	1.49	1.48	a	a	b	b	b	a	a	b
実施例7	シフトナー(7)	1.50	1.49	1.49	1.47	a	b	b	b	b	a	b	b
実施例8	シフトナー(8)	1.51	1.49	1.48	1.47	a	b	b	b	b	a	a	b
実施例9	シフトナー(9)	1.50	1.51	1.47	1.48	a	b	b	b	b	a	b	b
実施例10	シフトナー(10)	1.50	1.50	1.47	1.49	a	a	b	b	b	b	b	b
実施例11	シフトナー(11)	1.50	1.50	1.50	1.50	a	a	a	a	a	a	a	a
比較例1	シフトナー(12)	1.51	1.50	1.48	1.50	b	b	c	c	c	a	c	c
比較例2	シフトナー(13)	1.50	1.45	1.40	1.40	b	d	d	e	e	a	c	d
比較例3	シフトナー(14)	1.51	1.50	1.45	1.37	a	d	d	e	b	a	b	c
比較例4	シフトナー(15)	1.48	1.46	1.47	1.39	a	c	d	d	c	a	b	b
比較例5	シフトナー(16)	1.38	1.27	中止	中止	e	e	中止	中止	e	d	中止	中止
比較例6	シフトナー(17)	1.49	1.50	1.50	1.49	c	b	b	b	b	a	b	c
比較例7	シフトナー(18)	1.50	1.48	1.46	1.45	c	c	c	d	b	b	b	c
比較例8	シフトナー(19)	1.51	1.48	1.44	1.38	a	d	e	e	b	b	c	c
比較例9	シフトナー(20)	1.47	1.29	1.35	1.33	b	d	d	d	c	c	c	d

[0386] the C.I. pigment blue 15:3 used in the example 12 example 1 — in addition, the C.I. pigment red 122 — 11 weight sections and the C.I. pigment yellow 17 — 14 weight sections and carbon black — each 10 weight section — the ** ***** — if things were removed, the Magenta toner particle (6), the yellow toner particle (7), and the black toner particle (8) were manufactured like the example 1, respectively.

[0387] It was filled up with 160g (1) of nonmagnetic one component system developers used for cyanogen development counter 4C in the example 1 using the LBP-2030 reconstruction machine used in the example 1, Magenta development counter 4M were filled up with the 160g (21) of the above-mentioned nonmagnetic one component system developers, yellow development counter 4Y was filled up with the 160g (22) of the above-mentioned nonmagnetic one component system developers, and black development counter 4Bk was filled up with the 160g (23) of the above-mentioned nonmagnetic one component system developers.

[0388] Image formation was performed on condition that the following.

[0389] — Primary electrification conditions : the direct current voltage of -600V and the electrification bias voltage on which the alternating voltage of amplitude 2kVpp was made to superimpose by the 1150Hz sine wave were impressed to the electrification roller 2 from the power supply which is not illustrated in drawing 1 . By impressing voltage to the electrification roller 2, the charge was moved by discharge to the photoconductor drum 1 of an insulating material, and it was charged uniformly.

[0390] — Latent-image formation conditions : on the photoconductor drum 1 charged uniformly, exposure exposure of the laser beam E was carried out, and the electrostatic latent image was formed. The surface potential of the exposed portion set up laser beam reinforcement so that it might be set to -200V.

[0391] The multiplex toner image of four colors which developed negatives by the color order of

yellow, a Magenta, cyanogen, and black, imprinted the toner image of each color primarily to middle imprint drum lifting one by one, and were primarily imprinted by middle imprint drum lifting was collectively imprinted secondarily on record material, heating fixing of the multiplex toner image of these four colors was carried out at record material, and the full color image was formed.

[0392] To the yellow development counter of 4in drawing 1 Y at each of yellow development counter 4Y in drawing 1, Magenta development counter 4M, cyanogen development counter 4C, and black development counter 4Bk Development conditions : - The direct current voltage of -350V, The thing on which the alternating voltage of amplitude 2kVpp was made to superimpose by the 2300Hz sine wave was made to impress, the alternating electric field was formed between (300 micrometers of gaps) the development sleeve and the photoconductor drum 1, and negatives were developed by making the toner on a development sleeve (170 micrometers of toner thickness) fly.

[0393] - Primary imprint conditions : in order to imprint primarily the toner image developed by development counter 4Y on the middle imprint object 5, primary imprint bias voltage impressed to drum 5a made from aluminum was made into the direct current voltage of +100V. In order to imprint primarily the toner image developed by development counter 4M on the middle imprint object 5, primary imprint bias voltage impressed to drum 5a made from aluminum was made into the direct current voltage of +200V. In order to imprint primarily the toner image developed by development counter 4C on the middle imprint object 5, primary imprint bias voltage impressed to drum 5a made from aluminum was made into the direct current voltage of +300V. In order to imprint primarily the toner image developed by development counter 4Bk on the middle imprint object 5, primary imprint bias voltage impressed to drum 5a made from aluminum was set to +400V.

[0394] Secondary imprint conditions: In order to imprint collectively the full color toner image of four colors primarily imprinted on the middle imprint object 5 secondarily to the record material P, the direct current voltage of +2000V was impressed to the imprint means 8 as secondary imprint bias voltage.

[0395] Consequently, also in 5000 sheet copy paper, each of image concentration of a fixing image, fogging control in the paper, and thin line repeatability was excellent, it was stabilized and the full color image excellent in color tone repeatability was able to be obtained.

[0396] The full color image was formed in the development sections 17a, 17b, 17c, and 17d of the image formation equipment shown in example 13 drawing 2 using the nonmagnetic one component system developer (21) manufactured in the nonmagnetic one component system developer (1) and example 12 which were manufactured in the example 1 using the full color image formation equipment using the developer 170 of a nonmagnetic one component system development method using the nonmagnetic one component system developer shown in drawing 6, respectively, (22), and (23).

[0397] The development counter of development section 17a is filled up with a nonmagnetic one component system developer (21). To the development counter of development section 17b It is filled up with a nonmagnetic one component system developer (1). To the development counter of development section 17c It is filled up with a nonmagnetic one component system developer (22). To the development counter of 17d of development sections It was filled up with the nonmagnetic one component system developer (23), and by the color order of black, cyanogen, a Magenta, and yellow, the line formed the multiplex toner image of four colors for the development of an electrostatic latent image, and the imprint to the record agent as imprint material on record material one by one on condition that the following, heating fixing was carried out at record material, and the full color image was formed.

[0398] electrostatic latent-image: formed in the photo conductor -150V development bias voltage: — dc-component; -300V and alternating current component; — developer thickness:170micrometer development bias voltage:imprint section 24a;+100 on the distance:300-micrometer development sleeve of 2000Hz, an amplitude 1.8kVpp photo conductor drum, and a development sleeve — V and imprint section 24b;+170 — V, imprint section 24c;+240V, and imprint section 24d;+310 — V [0399] Consequently, also by **** over the long period of time of

20000 sheets, it excelled in the image concentration of a fixing image, fogging control in the paper, and thin line repeatability, and it was stabilized and the full color image excellent in color tone repeatability was able to be obtained.

[0400] The full color image was formed in the development counter 244-1, 244-2, 244-3 of the image formation equipment shown in example 14 drawing 5, and 244-4 using the nonmagnetic one component system developer (21) manufactured in the nonmagnetic one component system developer (1) and example 12 which were manufactured in the example 1 using the full color image formation equipment using the developer 170 of a nonmagnetic one component system development method using the nonmagnetic one component system developer shown in drawing 6, respectively, (22), and (23).

[0401] The development counter of a development counter 244-1 is filled up with a nonmagnetic one component system developer (23). To a development counter 244-2 It is filled up with a nonmagnetic one component system developer (21). To a development counter 244-3 It is filled up with a nonmagnetic one component system developer (1). To a development counter 244-4 It is filled up with a nonmagnetic one component system developer (22), and negatives are developed by the color order of black, a Magenta, cyanogen, and yellow. The package imprint of the multiplex toner image of four colors which imprinted the toner image of each color to middle imprint drum lifting one by one, and were imprinted by middle imprint drum lifting was carried out at record material, heating fixing was carried out and the full color image was formed in record material.

[0402] middle imprint drum: — charged-body; — aluminum and elastic layer; sterene-butadiene rubber — 5mm [in thickness] primary electrification condition: — dc-component; -600V and alternating current component; — 2000Hz electrostatic latent-image: formed in the amplitude 1.8kVpp photo conductor -250V development bias voltage: — dc-component; -400V —

Alternating current component; 2000Hz, developer thickness: 170micrometer primary imprint condition: imprint section 24a; direct-current-voltage +100V on the distance: 300-micrometer development sleeve of an amplitude 1.8kVpp photo conductor drum and a development sleeve, Imprint section 24b; direct-current-voltage +150V, imprint section 24c; direct-current-voltage +200V, imprint section 24d; direct-current-voltage +250V secondary imprint condition: direct-current-voltage +2000V [0403] Consequently, also by **** over the long period of time of 15000

sheets, it excelled in the image concentration of a fixing image, fogging control in the paper, and thin line repeatability, and it was stabilized and the full color image excellent in color tone repeatability was able to be obtained.

[0404]

[Effect of the Invention] According to this invention, a developer does not deteriorate in durability over a long period of time, it excels in image concentration stability and minute section repeatability, and the image which fogging does not produce can be obtained.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is explanatory drawing of the image formation equipment which can enforce the image formation method using the toner of this invention.

[Drawing 2] It is explanatory drawing of the image formation equipment which can enforce other image formation methods using the toner of this invention.

[Drawing 3] It is explanatory drawing of the image formation equipment which can enforce other image formation methods using the toner of this invention.

[Drawing 4] It is explanatory drawing of the image formation equipment which can enforce other image formation methods using the toner of this invention.

[Drawing 5] It is explanatory drawing of the image formation equipment which can enforce other image formation methods using the toner of this invention.

[Drawing 6] It is explanatory drawing of the developer using the nonmagnetic one component system development method using the toner of this invention.

[Drawing 7] It is explanatory drawing of the developer using the binary system development method using the toner of this invention.

[Drawing 8] It replaces with the middle imprint object of the shape of a drum of the image formation equipment shown by drawing 1 , and is explanatory drawing of the image formation equipment using a belt-like middle imprint object.

[Drawing 9] The pattern used in order to evaluate the expression nature of a minute section image is shown.

[Drawing 10] It is the mimetic diagram showing the particle shape of non-globular form-like non-subtlety powder (B).

[Drawing 11] It is a block diagram at the time of applying the image formation equipment of this invention to the printer of facsimile apparatus.

[Description of Notations]

1 Photo Conductor Drum (Latent-Image Support)

2 Electrification Roller

3 Rodding (Middle Imprint Object Means)

4 4Y, 4M, 4C, 4Bk Development Counter

5 Middle Imprint Object

6 Cleaning Device

7 Tray

8 Imprint Means

9 Fixing Assembly

9a Fixing roller

9b Pressurization roller

L Light equipment

E Laser light

119 Photoconductor Drum (Latent-Image Support)

120 Developer

121 Development Sleeve (Developer Support)

122 Sleeve Base
123 Magnet
124 Conveyance Screw
125 Conveyance Screw
126 Development Container
127 Development Blade
128 Developer
129 Toner for Supply
130 Septum
131 Opening
169 Latent-Image Support
170 Developer
171 Development Container
172 Development Sleeve (Developer Support)
173 Feed Roller
174 Elastic Blade (Developer Thickness Specification-Part Material)
175 Stirring Member
176 Nonmagnetic 1-Component Developer

[Translation done.]

* NOTICES *

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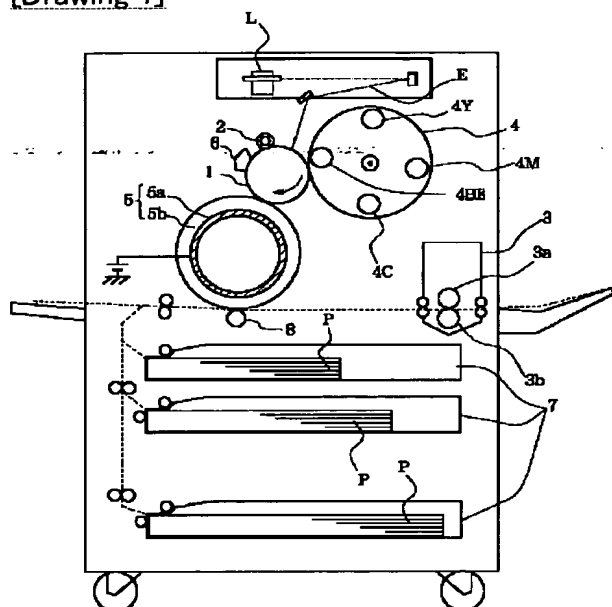
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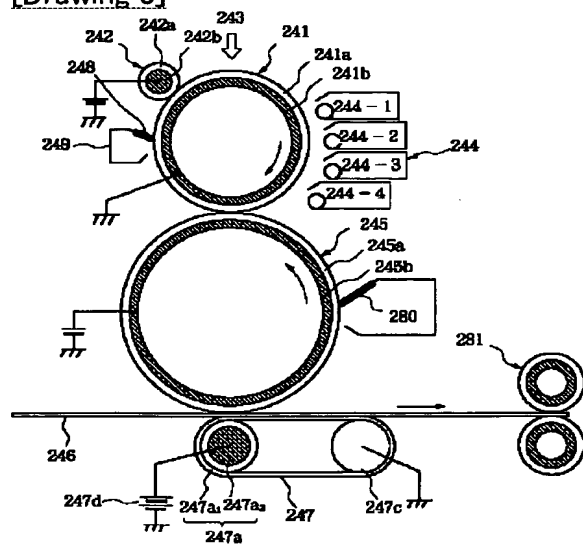
3.In the drawings, any words are not translated.

DRAWINGS

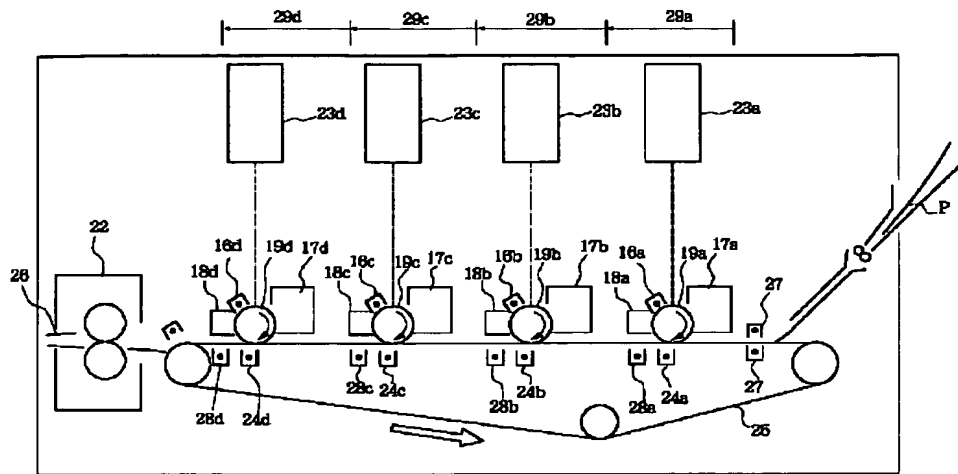
[Drawing 1]



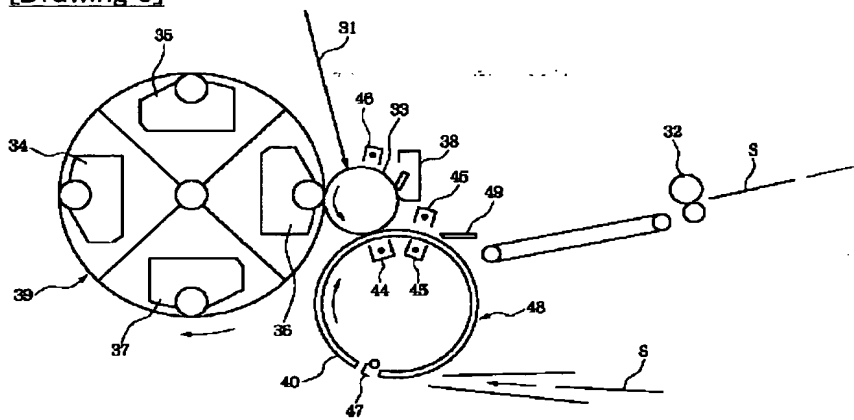
[Drawing 5]



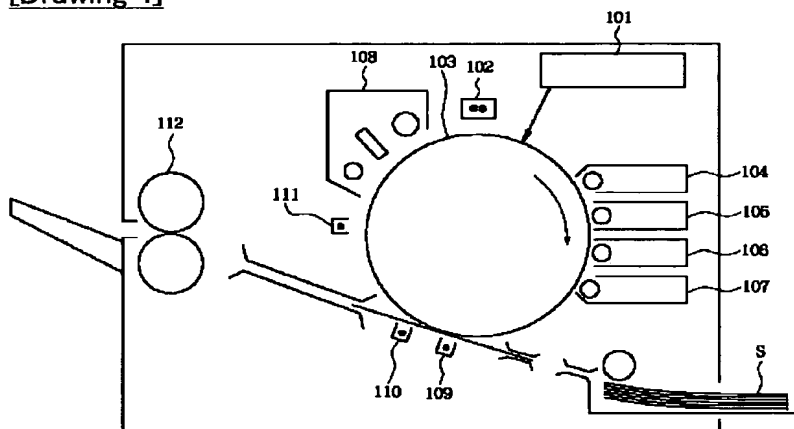
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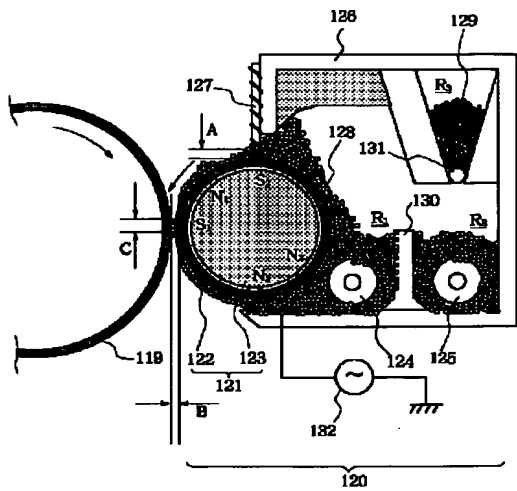
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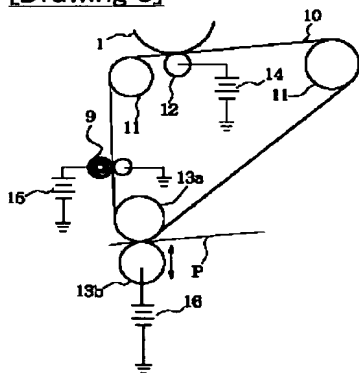
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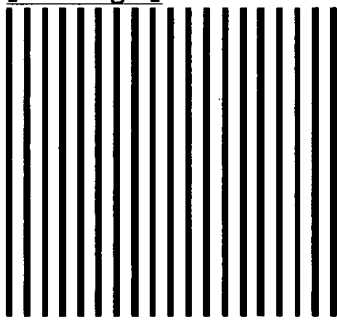
[Drawing 7]



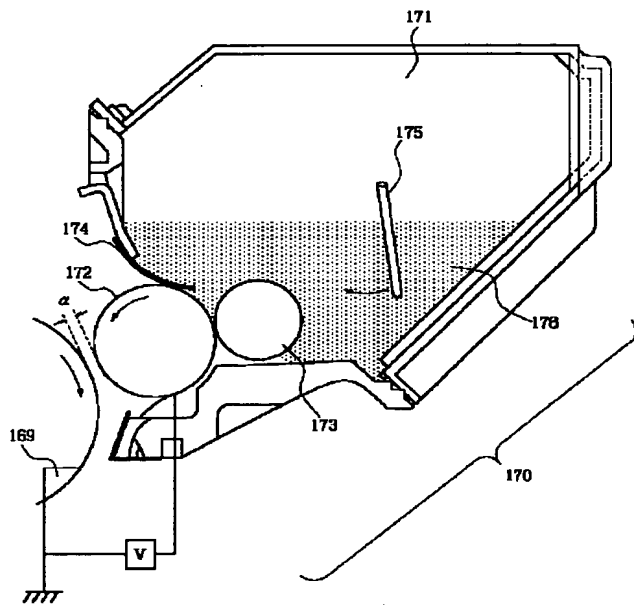
[Drawing 8]



[Drawing 9]



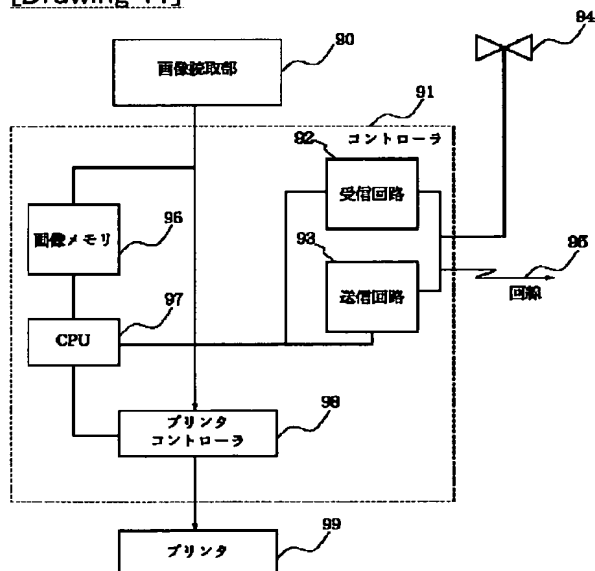
[Drawing 6]



[Drawing 10]



[Drawing 11]



[Translation done.]

合開始剤の存在下で、溶媒体中で重合する重合法によって製造されたものであることを特徴とする請求項1乃至18のいずれかに記載のトナー。

【請求項20】 該トナー粒子は、重合性モノマー及び着色剤を少なくとも含有する重合性モノマー組成物を重合開始剤の存在下で、水系媒体中で懸濁重合する重合法によって製造されたものであることを特徴とする請求項1乃至18のいずれかに記載のトナー。

【請求項21】 該トナーは、非磁性トナーであることと特徴とする請求項1乃至20のいずれかに記載のトナーを特徴とする請求項1乃至20のいずれかに記載のトナー。

【請求項22】 該トナーは、一成分系現像剤として用いられることを特徴とする請求項1乃至20のいずれかに記載のトナー。

【請求項23】 該トナーは、非磁性トナーであり、該非磁性トナーは、非磁性一成分系現像剤として用いられ、該非磁性トナーは、非磁性一成分系現像剤として用いられることを特徴とする請求項1乃至20のいずれかに記載のトナー。

【請求項24】 結着樹脂及び着色剤を少なくとも含有するトナー粒子及び外添剤微粉末を有するトナーとキャリアとを有する二成分系現像剤において、該トナーは、フロー式粒子像分析装置によって測定される粒子の円形度分布及び円相当径による粒度分布において、0.950乃至0.995の平均円形度を有し、円相当径3.0乃至9.0 μm の領域に極大値Xを有し、円相当径0.6乃至2.00 μm の領域に極大値Yを有し、円相当径0.6乃至2.00 μm 以上2.00 μm 未満の粒子を8.0乃至30.0個数％含有しており、

該外添剤微粉末は、該トナー粒子上で、一次粒子の個数平均長径が1 μm 以上30 μm 未満の無機微粉末(A)及び粒子が複数合一することにより生成された形状係数SF-1が150より大きく、且つ個数平均長径が30乃至600 μm の非球形無機微粉末(B)を少なくとも有していることを特徴とする二成分系現像剤。

【請求項25】 該トナーは、フロー式粒子像分析装置によって測定される粒子の円形度分布において、0.960乃至0.995の平均円形度を有していることを特徴とする請求項24に記載の二成分系現像剤。

【請求項26】 該無機微粉末(A)は、該トナー粒子上で、一次粒子が1 μm 乃至25 μm の個数平均長径を有していることを特徴とする請求項24又は25に記載の二成分系現像剤。

【請求項27】 該無機微粉末(A)は、該トナー粒子上で、一次粒子が1.0乃至1.5の長径と短径との比(長径/短径)を有していることを特徴とする請求項24乃至26のいずれかに記載の二成分系現像剤。

【請求項28】 非球形無機微粉末(B)は、該トナー粒子上で、30 μm 乃至300 μm の個数平均長径を有していることを特徴とする請求項24乃至27の

記載の二成分系現像剤。

いずれかに記載の二成分系現像剤。

【請求項29】 該トナー粒子上で、該非球形無機微粉末(B)は、30 μm 乃至200 μm のファイル径最小幅の平均値を有する一次粒子が複数合一することにより生成されたものである請求項24乃至28のいずれかに記載の二成分系現像剤。

【請求項30】 該無機微粉末(A)は、5.0乃至150 m^2/g のBET法で測定される比表面積を有していることを特徴とする請求項24乃至29のいずれかに記載の二成分系現像剤。

【請求項31】 該非球形無機微粉末(B)は、20乃至90 m^2/g のBET法で測定される比表面積を有していることを特徴とする請求項24乃至30のいずれかに記載の二成分系現像剤。

【請求項32】 該無機微粉末(A)は、該トナー粒子上で、100乃至125の形状係数SF-1を有していることを特徴とする請求項24乃至31のいずれかに記載の二成分系現像剤。

【請求項33】 該非球形無機微粉末(B)は、該トナー粒子上で、190より大きい形状係数SF-1を有していることを特徴とする請求項24乃至32のいずれかに記載の二成分系現像剤。

【請求項34】 該非球形無機微粉末(B)は、該トナー粒子上で、200より大きい形状係数SF-1を有していることを特徴とする請求項24乃至32のいずれかに記載の二成分系現像剤。

【請求項35】 該トナー粒子上で、該無機微粉末(A)は、一次粒子が単独又は凝集した状態で存在しており、

該トナーの電子顕微鏡拡大写真において、0.5 μm ×0.5 μm の面積当たり此処又は凝集した状態で存在している該無機微粉末(A)の一次粒子の合計が20個以上、及び1.0 μm ×1.0 μm の面積当たり非球形無機微粉末(B)が平均で1乃至20個、該トナー粒子の表面に存在していることを特徴とする請求項24に記載の二成分系現像剤。

【請求項36】 該トナー粒子上で、該無機微粉末(A)は、一次粒子が単独又は凝集した状態で存在しており、

該トナーの電子顕微鏡拡大写真において、0.5 μm ×0.5 μm の面積当たり此処又は凝集した状態で存在している該無機微粉末(A)の一次粒子の合計が25個以上、及び1.0 μm ×1.0 μm の面積当たり非球形無機微粉末(B)が平均で2乃至18個、該トナー粒子の表面に存在していることを特徴とする請求項24に記載の二成分系現像剤。

【請求項37】 該トナーは、該トナー100重量部中に該無機微粉末(A)を0.1乃至3.0重量部含有していることを特徴とする請求項24乃至36のいずれかに記載の二成分系現像剤。

記載の二成分系現像剤。

【請求項38】 該トナーは、該トナー100重量部中に該非球形無機微粉末(B)を0.1乃至3.0重量部含有していることを特徴とする請求項24乃至37のいずれかに記載の二成分系現像剤。

【請求項39】 該無機微粉末(A)及び該非球形無機微粉末(B)は、シリカ、アルミナ、チタニア及びそれらの組成物からなるグループから選択される微粒子を有していることを特徴とする請求項24乃至38のいずれかに記載の二成分系現像剤。

【請求項40】 該無機微粉末(A)及び該非球形無機微粉末(B)は、シリカ微粒子を有していることを特徴とする請求項24乃至38のいずれかに記載の二成分系現像剤。

【請求項41】 該無機微粉末(A)及び該非球形無機微粉末(B)は、シリコンオイルを有していることを特徴とする請求項24乃至40のいずれかに記載の二成分系現像剤。

【請求項42】 該トナー粒子は、重合性モノマー及び着色剤を少なくとも含有する重合性モノマー組成物を重合開始剤の存在下で、溶媒体中で懸濁重合する重合法によって製造されたものであることを特徴とする請求項24乃至41のいずれかに記載の二成分系現像剤。

【請求項43】 該トナー粒子は、重合性モノマー及び着色剤を少なくとも含有する重合性モノマー組成物を重合開始剤の存在下で、水系媒体中で懸濁重合する重合法によって製造されたものであることを特徴とする請求項24乃至42のいずれかに記載の二成分系現像剤。

【請求項44】 該トナーは、非磁性トナーであることと特徴とする請求項24乃至41のいずれかに記載のトナー。

【請求項45】 (I) 静電潜像を担持するための潜像担持体を有する帯電工程；(II) 帯電された潜像担持体に静電潜像を形成する潜像形成工程；(III) 該潜像担持体の静電潜像をトナーにより現像してトナー画像を形成する現像工程；及び(IV) 該静電潜像担持体上に形成されたトナー画像を転写材に転写する転写工程；を有する画像形成方法において、

該トナーは、結着樹脂及び着色剤を少なくとも含有するトナー粒子及び外添剤微粉末を有しており、

該トナーは、フロー式粒子像分析装置によって測定される粒子の円形度分布及び円相当径による粒度分布において、0.950乃至0.995の平均円形度を有し、円相当径3.0乃至9.0 μm の領域に極大値Xを有し、円相当径0.6乃至2.00 μm の領域に極大値Yを有し、円相当径0.6乃至2.00 μm 以上2.00 μm 未満の粒子を8.0乃至30.0個数％含有しており、

該外添剤微粉末は、該トナー粒子上で、一次粒子の個数平均長径が1 μm 以上30 μm 未満の無機微粉末(A)及び粒子が複数合一することにより生成された形状係数SF-1が150より大きく、且つ個数平均長径

記載の二成分系現像剤。

が30乃至600 μm の非球形無機微粉末(B)を少なくとも有していることを特徴とする画像形成方法。

【請求項46】 該トナーは、フロー式粒子像分析装置によって測定される粒子の円形度分布において、0.960乃至0.995の平均円形度を有していることを特徴とする請求項45に記載の画像形成方法。

【請求項47】 該無機微粉末(A)は、該トナー粒子上で、一次粒子が1 μm 乃至25 μm の個数平均長径を有していることを特徴とする請求項45又は46に記載の画像形成方法。

【請求項48】 該無機微粉末(A)は、該トナー粒子上で、一次粒子が1.0乃至1.5の長径と短径との比(長径/短径)を有していることを特徴とする請求項45乃至47のいずれかに記載の画像形成方法。

【請求項49】 非球形無機微粉末(B)は、該トナー粒子上で、30 μm 乃至300 μm の個数平均長径を有していることを特徴とする請求項45乃至48のいずれかに記載の画像形成方法。

【請求項50】 該トナー粒子上で、該非球形無機微粉末(B)は、30 μm 乃至200 μm のファイル径最小幅の平均値を有する一次粒子が複数合一することにより生成されたものである請求項45乃至49のいずれかに記載の画像形成方法。

【請求項51】 該無機微粉末(A)は、5.0乃至150 m^2/g のBET法で測定される比表面積を有していることを特徴とする請求項45乃至50のいずれかに記載の画像形成方法。

【請求項52】 該非球形無機微粉末(B)は、20乃至90 m^2/g のBET法で測定される比表面積を有していることを特徴とする請求項45乃至51のいずれかに記載の画像形成方法。

【請求項53】 該無機微粉末(A)は、該トナー粒子上で、100乃至125の形状係数SF-1を有していることを特徴とする請求項45乃至52のいずれかに記載の画像形成方法。

【請求項54】 該非球形無機微粉末(B)は、該トナー粒子上で、190より大きい形状係数SF-1を有していることを特徴とする請求項45乃至53のいずれかに記載の画像形成方法。

【請求項55】 該非球形無機微粉末(B)は、該トナー粒子上で、200より大きい形状係数SF-1を有していることを特徴とする請求項45乃至53のいずれかに記載の画像形成方法。

【請求項56】 該トナー粒子上で、該無機微粉末(A)は、一次粒子が単独又は凝集した状態で存在しており、

該トナーの電子顕微鏡拡大写真において、0.5 μm ×0.5 μm の面積当たり単独又は凝集した状態で存在している該無機微粉末(A)の一次粒子の合計が平均で20個以上、及び1.0 μm ×1.0 μm の面積当たり非

記載の二成分系現像剤。

(9) 1) 顕微鏡像の撮得工程は、トナーにより現像してトナー画像を形成する現像工程；及び (IV) 露光装置担持体上に形成されたトナー画像を転写材に転写する転写工程；を有する画像形成方法において、該トナーは、結着樹脂及び着色剤を少なくとも含有するトナー粒子及び外添剤微粉末を有しており、該トナーは、フロッ式粒子像分析装置によって測定される粒子の円形度及び円相当径による粒度分布において、0.950乃至0.995の平均円形度を有し、円相当径3.0乃至9.0 μm の領域に極大値Yを有し、円相当径0.6乃至2.0 μm の領域に極大値Xを有し、円相当径0.6 μm 以上2.0 μm 未満の粒子を8.0乃至30.0個数%含有しており、該外添剤微粉末は、該トナー粒子上で、一次粒子の個数平均長径が1 μm 以上30 μm 未満の無機微粉末 (A) 及び粒子が複数合一することにより生成された形状係数SF-1が150より大きく、且つ個数平均長径が3.0乃至60 μm の非球形無機微粉末 (B) を少なくとも有していることを特徴とする画像形成方法に関する。

[0022] 本発明は、画像形成装置本体に容易可能に装着される装置ユニットにおいて、該装置ユニットは、結着樹脂及び着色剤を含有するトナー粒子と外添剤微粉末とを少なくとも有する一成分系現像剤としてのトナーを、該一成分系現像剤を受容するための現像容器；及び、該現像容器に収容されている一成分系現像剤を担持し、且つ現像領域に搬送するための現像剤担持体を有しており、該トナーは、フロッ式粒子像分析装置によって測定される粒子の円形度分布及び円相当径による粒度分布において、0.950乃至0.995の平均円形度を有し、円相当径3.0乃至9.0 μm の領域に極大値Xを有し、円相当径0.6乃至2.0 μm の領域に極大値Yを有し、円相当径0.6 μm 以上2.0 μm 未満の粒子を8.0乃至30.0個数%含有しており、該外添剤微粉末は、該トナー粒子上で、一次粒子の個数平均長径が1 μm 以上30 μm 未満の無機微粉末 (A) 及び粒子が複数合一することにより生成された形状係数SF-1が150より大きく、且つ個数平均長径が3.0乃至60 μm の非球形無機微粉末 (B) を少なくとも有していることを特徴とする装置ユニットに関する。

[0023] [発明の実施の形態] 本発明者らが鋭意研究を行なった結果、特定の円形度分布及び円相当径による特定の粒度分布を有するトナーに用いる外添剤微粉末として、特定の形状及び特定の個数平均長径を有する微粉末を少なくとも2種用いることによって、長期に渡る使用においてもトナー劣化が生じることなく、画像濃度安定性、精細部再現性に優れ、カブリの生じない画像が得られることを見出した。

[0024] 上記の効果の得られる理由について、その

詳細は不明であるが、以下のように推察される。
[0025] 本発明者らは鋭意検討の結果、現像剤劣化には以下の三つの現象が関係していることを明らかにした。
[0026] 第一の現象は、トナー粒子の凸部破壊及び微粒子化である。第二の現象は、外添剤のトナー粒子表面への埋没である。第三の現象は、トナー粒子の帯電特性の不均一化である。

[0027] 上記の諸現象をふまえ、本発明に至ったものである。

[0028] 本発明の形態について、以下に更に詳細に述べる。

[0029] 本発明のトナーは、フロッ式粒子像測定装置によって測定される円相当径による粒度分布において、平均円形度が0.950〜0.995、好ましくは0.960〜0.995であることが好ましい。ここにフロッ式粒子像測定装置とは粒子像の画像解析を統計的に行う装置であり、平均円形度は該装置を用い次式によって求められた円形度の相加平均によって算出される。

[0030]

$$\text{円形度} = \frac{\text{相当円の周長}}{\text{粒子像の周長}} \quad \text{[外1]}$$

[0031] 上記において、粒子投影像の周長とは、二値化された粒子像のエッジ点を結んで得られる輪郭線の長さであり、相当円の周長とは、二値化された粒子像と同じ面積を有する円の外周の長さである。

[0032] トナーの平均円形度が0.950未満では、トナー粒子同士、あるいはトナー粒子とトナー担持体の如きトナーに電荷を付与する部材との摩擦が大きくなるため、トナー粒子の破壊、微粒子化が生じ、カブリ抑制、高精密性に劣る画像となる。トナーの平均円形度が0.995を超える場合では、摩擦による荷電が行われにくいトナーとなり、均一性に劣る画像となる。

[0033] 本発明のトナーは、フロッ式粒子像測定装置によって測定される円相当径による粒度分布において、円相当径3.0〜9.0 μm に極大値Xを有し、円相当径0.60〜2.0 μm に極大値Yを有し、円相当径0.60以上2.0 μm 未満の粒子を8.0〜30.0個数%含有していることが良い。ここで極大値Yを構成する粒子は、流動性を適正な値にまで低下させる役割を担っている。

[0034] フロッ式粒子像測定装置によって測定される粒子の円相当径による粒度分布において、第一のピークのみにある球状トナーは通孔に流動性が良いトナーとなるため、初期においてトナーの摩擦帯電が充分に行われることにより、長期に渡る使用においてもトナー劣化が生じることなく、画像濃度安定性、精細部再現性に優れ、カブリの生じない画像が得られることを見出した。

[0024] 上記の効果の得られる理由について、その

顕微鏡像にムラが生じる。円相当径0.60 μm 以上2.00 μm 未満の粒子の含有量が30.0個数%を超える場合には流動性低下効果が顕著に働き、流動性の悪いトナーとなるため、長期放置後の初期画像がきついたものとなる。

[0035] なお、上記効果は、画像形成方法として、中間転写を用いた場合に、より顕著となることから好ましい。その詳細な機構は不明であるが、例えばカラートナーを用いフルカラー画像を中間転写体上に形成する場合においては、トナーの流動性を適切な値にすること、中間転写体上のトナー像が不精細なものとなるのを防止で、駆動系から生じる微細振動の影響を受け難くなり、中間転写体上のトナー像が不精細なものとなるのを防止しているものと思われる。

[0036] 本発明において、円相当径による粒度分布における極大値XおよびYを得るための方法、および0.60 μm 以上2.00 μm 未満の円相当径を有する粒子の含有量を調整する方法としては、特に限定されるものではないが、例えば、トナー劣化に關して影響を及ぼさない粒子を適量添加する方法；重合法によりトナー粒子を製造する際に副生成させた乳化石を全量用いる方法；通式分級、風力分級のような分級法を用いて副生成させた乳化石の一部を除くことにより、一部の乳化石を用いる方法を用いることが可能である。

[0037] 本発明において、上述した特定の平均円形度を有するトナーを製造する方法としては、例えば、粉砕法により製造されたトナー粒子を球形化処理する際の球形化処理条件をコントロールしてトナーを製造する方法、及円相法によりトナー粒子を製造する際の重合条件をコントロールしてトナーを製造する方法が挙げられる。

[0038] 粉砕法により製造されたトナー粒子を球形化処理する方法としては、結着樹脂及び着色剤、さらに必要により離型剤及び荷電剤の如きトナー構成材料をベンジニルメキサー及びメデリア分級機の如き載式混合機を用いて均一分散混合させ、得られた混合物を加圧ニーダー及びエクストルuderの如き連続機を用いて溶融混練し、得られた混練物を冷却後、ハンマーミルの如き分級機を用いて粗粉砕し、得られた粗粉砕物をジェット気流ターゲットに衝突させて微粉砕させる微粉砕機を用いて微粉砕し、更に分級機を用いて粗粉及び微粉を分別により除去し粒度分布を調整する。粒度分布が調整された粒子は、例えば、トナー粒子を水中に分散させて加熱する溶出法；トナー粒子を熱気流中を通させる熱処理法；又はトナー粒子を機械的エネルギーによる衝撃力を与与する機械的衝撃法；によって球形化処理が施される。この球形化処理を施す際の処理温度、処理時間、及び処理エネルギーの如き処理条件を適宜コントロールすることにより、トナーの円形度を調整することができる。

[0039] 重合法によりトナー粒子を製造する方法と

しては、重合性単量体中に着色剤、さらに必要により離型剤及び荷電剤の如きトナー構成材料を重合開始剤と共に加え、ホモニライザー及び超音波分散機の如き混合機によって均一に溶解又は分散せしめた単量体組成物を、分散安定剤を含有する水中で、ホモニライザーにより分散せしめる。単量体組成物からなる溶液が所望のトナー粒子のサイズが得られた段階で、造粒を停止する。その後は分散安定剤の作用により、粒子状態が維持され、且つ粒子の沈降が防止される程度の乾燥を行えば良い。重合温度は40℃以上、一般的には50〜90℃の温度に設定して重合を行う。トナーの用結着樹脂の分子

量分布を調整する目的で、重合反応後半に昇温しても良く、更に、重合性の重合性単量体、副生成物を除去するために反応後半、又は、反応終了後に一部水系媒体を留去しても良い。反応終了後、生成したトナー粒子を洗浄・ろ過により回収し、乾燥する。懸濁重合法においては、通常単量体組成物100重量部に対して水300〜3000重量部を分散媒として使用するが好ましい。
[0040] 上記の重合法でトナー粒子を製造する際の分散安定剤の種類及び量、操作条件、水相のpH及び重合温度の如き重合条件をコントロールすることにより、トナーの円形度を調整することができる。

[0041] 本発明において、トナーの円相当径の円形度分布及び円相当径による粒度分布は、フロッ式粒子像分析装置FPIA-1000 (真価用電子社製) を用いて以下の通り測定される。

[0042] 測定は、フィルターを通して微細なごみを取り除き、その結果として10⁻³cm³の水中に測定値(例えば、円相当径0.60 μm 以上159.21 μm 未満)の粒子数が20個以下のイオン交換水中に界面活性剤 (好ましくは和光純薬製コンタミン) を0.1〜0.5重量%加えて調整した溶液約10ml (20℃) に、測定試料を約0.02g加えて均一分散させて試料分散液を調整した。分散させる手段としては、株式会社エスケーエー社製の超音波分散機UH-50 (振動子5 ϕ のチタン合金チップ) を用いた。分散時間は5分間以上とし、その際、分散媒の温度が40℃以上にならないように適宜冷却した。上記フロッ式粒子像分析装置を用い、0.60 μm 以上159.21 μm 未満の円相当径を有する粒子の粒度分布及び円形度分布を測定する。

[0043] 測定の設備は、真価用電子社 (株) 発行のFPIA-1000のカタログ (1995年6月版)、測定装置の操作マニュアル及び特開平8-136439号公報に記載されているが、以下の通りである。

[0044] 試料分散液は、フラットで扁平な透明フローセル (厚み約200 μm) の流路 (流れ方向に沿って広がっている) を通過させる。フローセルの厚みに対して交差して通過する光路を形成するように、ストロボとCCDカメラが、フローセルに対して、相互に反対側に

位置するように装置される。試料分散液が流れている間に、ストロブ光がフローセルを流れている粒子の画像を得るために1/30秒間隔で照射され、その結果、それぞれの粒子は、フローセルに平行な一定範囲を有する2次元画像として撮影される。それぞれの粒子の2次元画像の面積から、同一の面積を有する円の直径を相当直径として算出する。さらにそれぞれの粒子の2次元画像と同一面積を持つ円（相当円）の周囲長をそれぞれの粒子の2次元画像の周囲長で割って、それぞれの粒子の円形*

*度を算出する。

【0045】結果（傾度%及び累積%）は、表1に示す通り、0.06~400μmの範囲を226チャンネル（1オクターブ）に対し30チャンネルに分割し、得ることができる。実際の測定では、円相当径が60μm以上159.21μm未満の範囲で粒子の測定を行う。

【0046】

【表1】

相当径(μm)	傾度(%)	累積(%)	相当径(μm)	傾度(%)	累積(%)
0.06	0.00	0.00	159.21	0.00	100.00
0.07	0.00	0.00	160.00	0.00	100.00
0.08	0.00	0.00	160.79	0.00	100.00
0.09	0.00	0.00	161.58	0.00	100.00
0.10	0.00	0.00	162.37	0.00	100.00
0.11	0.00	0.00	163.16	0.00	100.00
0.12	0.00	0.00	163.95	0.00	100.00
0.13	0.00	0.00	164.74	0.00	100.00
0.14	0.00	0.00	165.53	0.00	100.00
0.15	0.00	0.00	166.32	0.00	100.00
0.16	0.00	0.00	167.11	0.00	100.00
0.17	0.00	0.00	167.90	0.00	100.00
0.18	0.00	0.00	168.69	0.00	100.00
0.19	0.00	0.00	169.48	0.00	100.00
0.20	0.00	0.00	170.27	0.00	100.00
0.21	0.00	0.00	171.06	0.00	100.00
0.22	0.00	0.00	171.85	0.00	100.00
0.23	0.00	0.00	172.64	0.00	100.00
0.24	0.00	0.00	173.43	0.00	100.00
0.25	0.00	0.00	174.22	0.00	100.00
0.26	0.00	0.00	175.01	0.00	100.00
0.27	0.00	0.00	175.80	0.00	100.00
0.28	0.00	0.00	176.59	0.00	100.00
0.29	0.00	0.00	177.38	0.00	100.00
0.30	0.00	0.00	178.17	0.00	100.00
0.31	0.00	0.00	178.96	0.00	100.00
0.32	0.00	0.00	179.75	0.00	100.00
0.33	0.00	0.00	180.54	0.00	100.00
0.34	0.00	0.00	181.33	0.00	100.00
0.35	0.00	0.00	182.12	0.00	100.00
0.36	0.00	0.00	182.91	0.00	100.00
0.37	0.00	0.00	183.70	0.00	100.00
0.38	0.00	0.00	184.49	0.00	100.00
0.39	0.00	0.00	185.28	0.00	100.00
0.40	0.00	0.00	186.07	0.00	100.00
0.41	0.00	0.00	186.86	0.00	100.00
0.42	0.00	0.00	187.65	0.00	100.00
0.43	0.00	0.00	188.44	0.00	100.00
0.44	0.00	0.00	189.23	0.00	100.00
0.45	0.00	0.00	190.02	0.00	100.00
0.46	0.00	0.00	190.81	0.00	100.00
0.47	0.00	0.00	191.60	0.00	100.00
0.48	0.00	0.00	192.39	0.00	100.00
0.49	0.00	0.00	193.18	0.00	100.00
0.50	0.00	0.00	193.97	0.00	100.00
0.51	0.00	0.00	194.76	0.00	100.00
0.52	0.00	0.00	195.55	0.00	100.00
0.53	0.00	0.00	196.34	0.00	100.00
0.54	0.00	0.00	197.13	0.00	100.00
0.55	0.00	0.00	197.92	0.00	100.00
0.56	0.00	0.00	198.71	0.00	100.00
0.57	0.00	0.00	199.50	0.00	100.00
0.58	0.00	0.00	200.29	0.00	100.00
0.59	0.00	0.00	201.08	0.00	100.00
0.60	0.00	0.00	201.87	0.00	100.00
0.61	0.00	0.00	202.66	0.00	100.00
0.62	0.00	0.00	203.45	0.00	100.00
0.63	0.00	0.00	204.24	0.00	100.00
0.64	0.00	0.00	205.03	0.00	100.00
0.65	0.00	0.00	205.82	0.00	100.00
0.66	0.00	0.00	206.61	0.00	100.00
0.67	0.00	0.00	207.40	0.00	100.00
0.68	0.00	0.00	208.19	0.00	100.00
0.69	0.00	0.00	208.98	0.00	100.00
0.70	0.00	0.00	209.77	0.00	100.00
0.71	0.00	0.00	210.56	0.00	100.00
0.72	0.00	0.00	211.35	0.00	100.00
0.73	0.00	0.00	212.14	0.00	100.00
0.74	0.00	0.00	212.93	0.00	100.00
0.75	0.00	0.00	213.72	0.00	100.00
0.76	0.00	0.00	214.51	0.00	100.00
0.77	0.00	0.00	215.30	0.00	100.00
0.78	0.00	0.00	216.09	0.00	100.00
0.79	0.00	0.00	216.88	0.00	100.00
0.80	0.00	0.00	217.67	0.00	100.00
0.81	0.00	0.00	218.46	0.00	100.00
0.82	0.00	0.00	219.25	0.00	100.00
0.83	0.00	0.00	220.04	0.00	100.00
0.84	0.00	0.00	220.83	0.00	100.00
0.85	0.00	0.00	221.62	0.00	100.00
0.86	0.00	0.00	222.41	0.00	100.00
0.87	0.00	0.00	223.20	0.00	100.00
0.88	0.00	0.00	223.99	0.00	100.00
0.89	0.00	0.00	224.78	0.00	100.00
0.90	0.00	0.00	225.57	0.00	100.00
0.91	0.00	0.00	226.36	0.00	100.00
0.92	0.00	0.00	227.15	0.00	100.00
0.93	0.00	0.00	227.94	0.00	100.00
0.94	0.00	0.00	228.73	0.00	100.00
0.95	0.00	0.00	229.52	0.00	100.00
0.96	0.00	0.00	230.31	0.00	100.00
0.97	0.00	0.00	231.10	0.00	100.00
0.98	0.00	0.00	231.89	0.00	100.00
0.99	0.00	0.00	232.68	0.00	100.00
1.00	0.00	0.00	233.47	0.00	100.00
1.01	0.00	0.00	234.26	0.00	100.00
1.02	0.00	0.00	235.05	0.00	100.00
1.03	0.00	0.00	235.84	0.00	100.00
1.04	0.00	0.00	236.63	0.00	100.00
1.05	0.00	0.00	237.42	0.00	100.00
1.06	0.00	0.00	238.21	0.00	100.00
1.07	0.00	0.00	239.00	0.00	100.00
1.08	0.00	0.00	239.79	0.00	100.00
1.09	0.00	0.00	240.58	0.00	100.00
1.10	0.00	0.00	241.37	0.00	100.00
1.11	0.00	0.00	242.16	0.00	100.00
1.12	0.00	0.00	242.95	0.00	100.00
1.13	0.00	0.00	243.74	0.00	100.00
1.14	0.00	0.00	244.53	0.00	100.00
1.15	0.00	0.00	245.32	0.00	100.00
1.16	0.00	0.00	246.11	0.00	100.00
1.17	0.00	0.00	246.90	0.00	100.00
1.18	0.00	0.00	247.69	0.00	100.00
1.19	0.00	0.00	248.48	0.00	100.00
1.20	0.00	0.00	249.27	0.00	100.00
1.21	0.00	0.00	250.06	0.00	100.00
1.22	0.00	0.00	250.85	0.00	100.00
1.23	0.00	0.00	251.64	0.00	100.00
1.24	0.00	0.00	252.43	0.00	100.00
1.25	0.00	0.00	253.22	0.00	100.00
1.26	0.00	0.00	254.01	0.00	100.00
1.27	0.00	0.00	254.80	0.00	100.00
1.28	0.00	0.00	255.59	0.00	100.00
1.29	0.00	0.00	256.38	0.00	100.00
1.30	0.00	0.00	257.17	0.00	100.00
1.31	0.00	0.00	257.96	0.00	100.00
1.32	0.00	0.00	258.75	0.00	100.00
1.33	0.00	0.00	259.54	0.00	100.00
1.34	0.00	0.00	260.33	0.00	100.00
1.35	0.00	0.00	261.12	0.00	100.00
1.36	0.00	0.00	261.91	0.00	100.00
1.37	0.00	0.00	262.70	0.00	100.00
1.38	0.00	0.00	263.49	0.00	100.00
1.39	0.00	0.00	264.28	0.00	100.00
1.40	0.00	0.00	265.07	0.00	100.00
1.41	0.00	0.00	265.86	0.00	100.00
1.42	0.00	0.00	266.65	0.00	100.00
1.43	0.00	0.00	267.44	0.00	100.00
1.44	0.00	0.00	268.23	0.00	100.00
1.45	0.00	0.00	269.02	0.00	100.00
1.46	0.00	0.00	269.81	0.00	100.00
1.47	0.00	0.00	270.60	0.00	100.00
1.48	0.00	0.00	271.39	0.00	100.00
1.49	0.00	0.00	272.18	0.00	100.00
1.50	0.00	0.00	272.97	0.00	100.00
1.51	0.00	0.00	273.76	0.00	100.00
1.52	0.00	0.00	274.55	0.00	100.00
1.53	0.00	0.00	275.34	0.00	100.00
1.54	0.00	0.00	276.13	0.00	100.00
1.55	0.00	0.00	276.92	0.00	100.00
1.56	0.00	0.00	277.71	0.00	100.00
1.57	0.00	0.00	278.50	0.00	100.00
1.58	0.00	0.00	279.29	0.00	100.00
1.59	0.00	0.00	280.08	0.00	100.00
1.60	0.00	0.00	280.87	0.00	100.00
1.61	0.00	0.00	281.66	0.00	100.00
1.62	0.00	0.00	282.45	0.00	100.00
1.63	0.00	0.00	283.24	0.00	100.00
1.64	0.00	0.00	284.03	0.00	100.00
1.65	0.00	0.00	284.82	0.00	100.00
1.66	0.00	0.00	285.61	0.00	100.00
1.67	0.00	0.00	286.40	0.00	100.00
1.68	0.00	0.00	287.19	0.00	100.00
1.69	0.00	0.00	287.98	0.00	100.00
1.70	0.00	0.00	288.77	0.00	100.00
1.71	0.00	0.00	289.56	0.00	100.00
1.72	0.00	0.00	290.35	0.00	100.00
1.73	0.00	0.00	291.14	0.00	100.00
1.74	0.00	0.00	291.93	0.00	100.00
1.75	0.00	0.00	292.72	0.00	100.00
1.76	0.00	0.00	293.51	0.00	100.00
1.77	0.00	0.00	294.30	0.00	100.00
1.78	0.00	0.00	295.09	0.00	100.00
1.79	0.00	0.00	295.88	0.00	100.00
1.80	0.00	0.00	296.67	0.00	100.00
1.81	0.00	0.00	297.46	0.00	100.00
1.82	0.00	0.00	298.25	0.00	100.00
1.83	0.00	0.00	299.04	0.00	100.00
1.84	0.00	0.00	299.83	0.00	100.00
1.85	0.00	0.00	300.62	0.00	100.00
1.86	0.00	0.00	301.41	0.00	100.00
1.87	0.00	0.00	302.20	0.00	100.00
1.88	0.00	0.00	302.99	0.00	100.00
1.89	0.00	0.00	303.78	0.00	100.00
1.90	0.00	0.00	304.57	0.00	100.00
1.91	0.00	0.00	305.36	0.00	100.00
1.92	0.00	0.00	306.15	0.00	100.00
1.93	0.00	0.00	306.94	0.00	100.00
1.94	0.00	0.00	307.73	0.00	100.00
1.95	0.00	0.00	308.52	0.00	100.00
1.96	0.00	0.00	309.31	0.00	100.00
1.97	0.00	0.00	310.10	0.00	100.00
1.98	0.00	0.00	310.89	0.00	100.00
1.99	0.00	0.00	311.68	0.00	100.00
2.00	0.00	0.00	312.47	0.00	100.00
2.01	0.00	0.00	313.26	0.00	100.00
2.02	0.00	0.00	314.05	0.00	100.00
2.03	0.00	0.00	314.84	0.00	100.00
2.04	0.00	0.00	315.63	0.00	

の蜜着吸着による比表面積 (BET比表面積) が、好ましくは2.0乃至90 m^2/g 、より好ましくは2.5乃至70 m^2/g であることが、無機微粉末 (A) の添加効果を妨げない点で良い。

【0079】非球形無機微粉末 (B) のBET比表面積が20 m^2/g 未満の場合には、広く用いられている攪拌混合機を使用するの操作操作の際に、非球形微粉末 (A) によって無機微粉末 (A) がトナー粒子表面上に既に埋め込まれてしまうため、無機微粉末 (A) の添加効果が低減する。

【0080】非球形無機微粉末 (B) のBET比表面積が90 m^2/g 未満の場合には、非球形無機微粉末 (A) の細孔内部に無機微粉末 (A) が取り込まれてしまい、無機微粉末 (A) の添加効果が低減する。

【0081】本発明においては、トナーの電子顕微鏡拡大写真において、0.5 $\mu\text{m} \times 0.5\mu\text{m}$ の面積当たり単独又は凝集した状態で存在している無機微粉末 (A) の一次粒子の合計が平均で好ましくは20個以上、より好ましくは25個以上トナー粒子の表面上に存在しており、1.0 $\mu\text{m} \times 1.0\mu\text{m}$ の面積当たり非球形無機微粉末 (B) が平均で、好ましくは1乃至20個、さらに好ましくは2乃至18個トナー粒子の表面上に存在していることが良い。尚、トナー粒子の表面上に存在している無機微粉末 (A) の一次粒子の合計数は、単独で存在している一次粒子と凝集体を構成している一次粒子との総数を意味する。

【0082】トナー粒子上に存在する無機微粉末 (A) の一次粒子の合計が平均で20個未満の場合には、流動性に劣るトナーとなり、均一性に劣る画像となる。

【0083】本発明における外部刺激微粉末の個数平均長径、長径と短径との比、平均フェレ径最小幅及びトナー粒子表面における外部刺激微粉末の存在個数の測定は、以下の通り行う。

【0084】無機微粉末 (A) の各数値の測定は、走査型電子顕微鏡FE-SEM (日立製作所製 S-4700) により10万倍に拡大したトナー粒子表面の写真を撮影し、その拡大写真を用いて長径1乃至40 μm の粒子を測定対象として行うが、一次粒子の長径及び短径の測定においては、後述する通り拡大倍率を10万倍乃至50万倍の範囲で適宜行う。

【0085】無機微粉末 (A) の一次粒子の平均長径は、拡大写真において無機微粉末 (A) の一次粒子の長径を10視野にわたって測定し、その平均値を平均長径とする。さらに、同様にして無機微粉末 (A) の一次粒子の短径の平均値を平均短径として求め、平均長径と平均短径との比 (長径/短径) として算出した。尚、無機微粉末 (A) の一次粒子の輪郭に接するようにより引いた平行線のうち、その平行線間が最大となる平行線間の距離を長径とし、平行線間が最小となる平行線間の距離を短径とする。

の蜜着吸着による比表面積 (BET比表面積) が、好ましくは2.0乃至90 m^2/g 、より好ましくは2.5乃至70 m^2/g であることが、無機微粉末 (A) の添加効果を妨げない点で良い。

【0079】非球形無機微粉末 (B) のBET比表面積が20 m^2/g 未満の場合には、広く用いられている攪拌混合機を使用するの操作操作の際に、非球形微粉末 (A) によって無機微粉末 (A) がトナー粒子表面上に既に埋め込まれてしまうため、無機微粉末 (A) の添加効果が低減する。

【0080】非球形無機微粉末 (B) のBET比表面積が90 m^2/g 未満の場合には、非球形無機微粉末 (A) の細孔内部に無機微粉末 (A) が取り込まれてしまい、無機微粉末 (A) の添加効果が低減する。

【0081】本発明においては、トナーの電子顕微鏡拡大写真において、0.5 $\mu\text{m} \times 0.5\mu\text{m}$ の面積当たり単独又は凝集した状態で存在している無機微粉末 (A) の一次粒子の合計が平均で好ましくは20個以上、より好ましくは25個以上トナー粒子の表面上に存在しており、1.0 $\mu\text{m} \times 1.0\mu\text{m}$ の面積当たり非球形無機微粉末 (B) が平均で、好ましくは1乃至20個、さらに好ましくは2乃至18個トナー粒子の表面上に存在していることが良い。尚、トナー粒子の表面上に存在している無機微粉末 (A) の一次粒子の合計数は、単独で存在している一次粒子と凝集体を構成している一次粒子との総数を意味する。

【0082】トナー粒子上に存在する無機微粉末 (A) の一次粒子の合計が平均で20個未満の場合には、流動性に劣るトナーとなり、均一性に劣る画像となる。

【0083】本発明における外部刺激微粉末の個数平均長径、長径と短径との比、平均フェレ径最小幅及びトナー粒子表面における外部刺激微粉末の存在個数の測定は、以下の通り行う。

【0084】無機微粉末 (A) の各数値の測定は、走査型電子顕微鏡FE-SEM (日立製作所製 S-4700) により10万倍に拡大したトナー粒子表面の写真を撮影し、その拡大写真を用いて長径1乃至40 μm の粒子を測定対象として行うが、一次粒子の長径及び短径の測定においては、後述する通り拡大倍率を10万倍乃至50万倍の範囲で適宜行う。

【0085】無機微粉末 (A) の一次粒子の平均長径は、拡大写真において無機微粉末 (A) の一次粒子の長径を10視野にわたって測定し、その平均値を平均長径とする。さらに、同様にして無機微粉末 (A) の一次粒子の短径の平均値を平均短径として求め、平均長径と平均短径との比 (長径/短径) として算出した。尚、無機微粉末 (A) の一次粒子の輪郭に接するようにより引いた平行線のうち、その平行線間が最大となる平行線間の距離を長径とし、平行線間が最小となる平行線間の距離を短径とする。

の埋没抑制の点で有効である。その理由は、粒子が複数合一することにより生成された非球形無機微粉末 (B) は、屈曲部を有する形状であるがゆえに、非球形無機微粉末 (B) がトナー粒子に埋没してしまうのを防ぐと共に、非球形無機微粉末 (B) がトナー粒子上でスベサーとして機能し、無機微粉末 (A) のトナー粒子への埋没を抑制するためと思われる。

【0070】さらに、非球形無機微粉末 (B) は、個数平均長径が30乃至600 μm 、好ましくは20乃至300 μm 、より好ましくは35乃至300 μm であることが、トナー粒子上でスベサーとして良好に機能することができ点で良い。

【0071】非球形無機微粉末 (B) の個数平均長径が30 μm 未満の場合には、無機微粉末 (A) 単独で添加効果と類似したものとなり、無機微粉末 (A) の埋没を抑制することが困難となる。

【0072】非球形無機微粉末 (B) の個数平均長径が60 μm を超える場合には、トナー粒子と非球形無機微粉末 (B) との層間に、トナー粒子表面に無機微粉末 (A) が埋没されるようになり、トナー劣化が生じ易い。

【0073】非球形無機微粉末 (B) のトナー粒子上の長径/短径と非 (長径/短径) が、好ましくは1.7以上、より好ましくは2.0以上、さらに好ましくは3.0以上であることが、トナー粒子表面への無機微粉末 (A) の埋没抑制効果が高い点で良い。

【0074】非球形無機微粉末 (B) の長径/短径が1.7未満の場合には、非球形無機微粉末 (B) は屈曲構造に乏しいものとなるため、非球形無機微粉末 (B) 自体がトナー粒子表面に埋没し易くなり、無機微粉末 (A) のトナー粒子への埋没抑制効果が低下する。

【0075】さらに、非球形無機微粉末 (B) は、該トナー粒子上で、好ましくは20 μm 乃至200 μm 、より好ましくは30 μm 乃至200 μm のフェレ径最小幅を有する一次粒子が複数合一することにより生成されたものであることが、トナー粒子表面への無機微粉末 (A) の埋没抑制効果が高い点で良い。

【0076】非球形無機微粉末 (B) の合一次粒子を構成する一次粒子の平均フェレ径最小幅が20 μm 未満の場合には、非球形無機微粉末 (B) の凝集性が增大するため、広く用いられている攪拌混合機を使用して非球形無機微粉末 (B) をトナー粒子表面上に均一に分散させることが困難となる。

【0077】非球形無機微粉末 (B) の合一次粒子を構成する一次粒子の平均フェレ径最小幅が200 μm を超える場合には、屈曲構造が乏しくなるのに加えて、トナー粒子と非球形無機微粉末 (B) との層間で、トナー粒子表面に無機微粉末 (A) が埋没しはじめるようになり、好ましくない。

【0078】非球形無機微粉末 (B) は、BET法で

【0086】尚、無機微粉末 (A) の長径及び短径の測定時に測定径が測定スケールで1mm以下の場合には、トナー粒子表面の拡大写真の拡大倍率を50万倍の範囲まで適宜拡大して測定する。

【0087】トナー粒子表面における無機微粉末 (A) の存在個数は、トナー粒子表面で、0.5 $\mu\text{m} \times 0.5\mu\text{m}$ (10万倍の拡大写真において50 $\text{mm} \times 50\text{mm}$) の面積当たりの無機微粉末 (A) の一次粒子の個数を、拡大写真1.0視野で数え、その平均値を算出することにより求めた。無機微粉末 (A) の個数をカウントする際には、拡大写真の中心部の0.5 $\mu\text{m} \times 0.5\mu\text{m}$ に相当する部分に存在する無機微粉末 (A) を対象とし、凝集している無機微粉末 (A) に関しては、凝集体を構成する一次粒子の個数を数えた。

【0088】非球形無機微粉末 (B) の各数値の測定は、走査型電子顕微鏡FE-SEM (日立製作所製 S-4700) により5万倍に拡大したトナー粒子表面の写真を撮影し、その拡大写真を用いて長径20 μm 以上の粒子を測定対象として行った。

【0089】非球形無機微粉末 (B) の平均長径は、拡大写真において非球形無機微粉末 (B) の長径を1.0視野にわたって測定し、その平均値を平均長径とする。さらに、同様にして非球形無機微粉末 (B) の短径の平均値を平均短径として求め、平均長径と平均短径との比 (長径/短径) として算出した。尚、非球形無機微粉末 (B) の合一次粒子を構成する一次粒子の平均フェレ径最小幅が20 μm 未満の場合には、非球形無機微粉末 (B) の凝集性が增大するため、広く用いられている攪拌混合機を使用して非球形無機微粉末 (B) をトナー粒子表面上に均一に分散させることが困難となる。

【0090】トナー粒子表面における非球形無機微粉末 (B) の存在個数は、トナー粒子表面で、0.5 $\mu\text{m} \times 1.0\mu\text{m}$ (5万倍の拡大写真において50 $\text{mm} \times 50\text{mm}$) の面積当たりの非球形無機微粉末 (B) の個数を、拡大写真1.0視野で数え、その平均値を算出することにより求めた。非球形無機微粉末 (B) の個数をカウントする際には、拡大写真の中心部の1.0 $\mu\text{m} \times 1.0\mu\text{m}$ に相当する部分に存在する非球形無機微粉末 (B) を対象とした。

【0091】非球形無機微粉末 (B) の合一次粒子を構成する一次粒子の平均フェレ径最小幅は、拡大写真において非球形無機微粉末 (B) を数視野にわたって20個以上サンプリングし、サンプリングした非球形無機微粉末 (B) の合一次粒子を構成する一次粒子のフェレ径最小幅を平均フェレ径最小幅とする。尚、非球形無機微粉末 (B) の合一次粒子を構成する一次粒子の輪郭に接するようにより引いた2本の平行線間の最小となる距離をフェレ径最小幅とする。

【0092】走査型電子顕微鏡拡大写真による無機微粉末 (B) は、

末 (A) と非球形無機微粉末 (B) との識別は、無機微粉末の粒子形状が明確に差がある場合には、走査型電子顕微鏡拡大写真における粒子形状の違いにより判断する方法、又は無機微粉末の組成差がある場合には、X線マイクロアナライザーにより指定した特定の元素のみを検出することにより無機微粉末 (A) と非球形無機微粉末 (B) とを別々に検出することで判断する方法を用いることができる。

【0093】本発明においては、無機微粉末 (A) および/または非球形無機微粉末 (B) がシリコーンオイルを含有していることが好ましい。シリコーンオイルで無機微粉末を処理することにより、該無機微粉末の疎水性が向上すると共に、非磁性一成分現像方式においては帯電部材が無機微粉末により傷つけられることでトナーの帯電特性が不均一になることを防止することが出来る。このとき、シリコーンオイルは無機微粉末より極小量のみ出し、潤滑剤としての役割を果たしているものであると推察される。

【0094】本発明においては、無機微粉末 (A) および/または非球形無機微粉末 (B) が無機化合物であることが好ましい。無機微粉末 (A) が有機化合物である場合には、長期に渡る使用に伴い、変形してトナー粒子表面に固着しやすい形状となる。一方、非球形無機微粉末 (B) が有機化合物である場合には、帯電部材との摩擦によって変形あるいは崩壊してしまい、スベサー粒子としての働きに劣るものとなる。

【0095】本発明に用いられる無機微粉末 (A) 及び (B) としては従来公知のものを用いることが出来るが、帯電安定性、現像性、流動性、保存性向上のため、シリカ、アルミナ、チタニアあるいはそれらの酸化物から選ばれたものが好ましい。なかでも、特にシリカが、出役材料あるいは温度の加減に条件により、ある程度任意に、一次粒径化、あるいは一次粒子の合一化をコントロールできる点で、より好ましい。例えば、かかるシリカは経路ハロゲン化合物やアルコキシンドの蒸気相酸化により生成されたいわゆる乾式法またはヒュムドシリカと称される乾式シリカ及びアルコキシンド、水ガラスから製造される湿式シリカの両者が使用可能であるが、表面及びシリカ微粉体の内部にあるシラノール基が少なく、またNa₂O、SO₃²⁻の如き製造残渣の少ない乾式シリカの方が好ましい。

【0096】非球形無機微粉末 (B) は、特に以下のような製法で製造されることが好ましい。

【0097】シリカ微粉末を例とした場合、ケイ酸ハロゲン化合物を気相酸化することにより、シリカ微粉末を生成し、得られたシリカ微粉末を疎水処理することにより非球状のシリカ微粉末を製造する。特に気相酸化の際、シリカの一次粒子が合一する程度の高温で焼成することが好ましい。

【0098】このような非球形無機微粉末 (B) は、

用不可となり、9重量%を超えるとカブリや機内飛散が増加し、現像剤の耐用寿命が短くなる。

【0146】次に、本発明のトナーを用いた画像形成方法及び装置ユニットに関する図面を用いて説明する。

【0147】図1および図8には、本発明の画像形成方法を中間転写を用いて多重トナー像を記録材に一括転写する画像形成装置の概略図を示す。

【0148】図1には、本発明の画像形成方法で中間転写ドラムを用いて、多重トナー像を記録材に一括転写する画像形成装置の概略図を示す。

【0149】潜像担持体としての感光体ドラム1の表面に、帯電部材としての帯電バイアス電圧が印加された回転可能な帯電ローラー2を回転させながら接触させて、感光体ドラム表面を均一に一次帯電し、露光手段として

の光源装置より発せられたレーザ光Eにより、感光体ドラム1上に第1の静電潜像を形成する。形成された第1の静電潜像は、回転可能なローラーユニット24

に設けられている第1の現像器としてブラック現像器4Bk中のブラックトナーにより現像され、ブラックトナー像を形成する。感光体ドラム1上に形成されたプラ

クトナー像は、中間転写ドラム1の導電性支持体に印加される転写バイアス電圧の作用により、中間転写ドラム5

上に静電的に一次転写される。次に、上記と同様にして感光体ドラム1の表面に第2の静電潜像を形成し、ロー

ラーユニット24を回転して、第2の現像器としてのイエロー現像器4Y中のイエロートナーにより現像して

イエロートナー像を形成し、ブラックトナー像が一次転写されている中間転写ドラム5上にイエロートナー像を

静電的に一次転写する。同様にして、第3の静電潜像及び第4の静電潜像をローラーユニット24を回転し

て、第3の現像器としてのマゼンタ現像器4M中のマゼンタトナー及び第4の現像器としてシアン現像器4C中の

シアントナーにより、順次現像及び一次転写を行う。で、中間転写ドラム5上に各色のトナー像をそれぞれ一

次転写する。中間転写ドラム5上に一次転写された多重トナー像は、記録材Pを介して反対側に位置する第2の

転写装置8からの転写バイアス電圧の作用により、記録材Pの上に静電的に一括に二次転写される。記録材P上

に二次転写された多重トナー像は加熱ローラー及び加圧ローラーを有する定着装置3により記録材Pに加熱定着

される。転写後に感光体ドラム1の表面に残存する転写残トナーは、感光体ドラム1の表面に当接するクリーニングブレードを有するクリーニングローラーで回収され、感光体

ドラム1はクリーニングされる。

【0150】感光体ドラム1から中間転写ドラム5へ的一次転写は、第1の転写装置としての中間転写ドラム5

の導電性支持体に、図示しない電源よりバイアスを付与することで転写電流が得られ、トナー画像の転写が行

れる。

【0151】中間転写ドラム5は、断体である導電性支

中で3日間硬化させ、得られた硬化物を四三酸化ルテニウム、必要により四三酸化オスミウムを併用し染色を施した後、ダイヤモンド磨を施したマイクロームを用いた薄片のサンプルを切り出し、透過電子顕微鏡(TEM)

を用いたトナー粒子の断面形態を観察した。本発明において、用いるコア部を構成する低軟化点物質とシェル部を構成する樹脂との若干の結晶化度の違いを利用して材

料間のコンタクトの若干の結晶化度の違いを利用して材色法を用いることが好ましい。

【0140】本発明のトナーは、トナーを有する一成分系現像剤として、又はトナーとキャリアを混合して二成分系現像剤として使用することができる。

【0141】本発明のトナーを二成分系現像剤として使用する場合には、キャリアとしては、例えば表面酸化又は表面酸化的な、ニッケル、銅、亜鉛、コバルト、マンガ

ン、クロム、希土類の如き酸性金属、それらの合金、それらの酸化物及びフレイタが使用できる。その製造方

法として特別な制約はない。

【0142】更に、帯電調整等の目的で上記キャリア粒子の表面を樹脂を有する被覆材で被覆することも好まし

い。その方法としては、樹脂を有する被覆材を溶剤中に溶解もしくは懸濁せしめて塗布し、キャリアに付着せし

める方法としては単に粉末で混合する方法の如き従来公知の方法がいずれも適用できるが、被覆層の安定のために

は、被覆材を溶剤中に溶解して塗布する方法の方が好ましい。

【0143】上記キャリアの表面への被覆材としては、トナー材料により異なるが、例えば、アミノアクリレー

ト樹脂、アクリル樹脂、或いはそれらの樹脂とスチレン系樹脂との共重合体、シリコーン樹脂、ポリエステル樹脂、フッ素樹脂、ポリテトラフルオロエチレン、モノク

ロロトリフルオロエチレン重合体、ポリフッ化ビニリド

ンが好適に使用されるが、必ずしもこれに制約されるものではない。これら化合物の被覆量は、キャリアの帯電

付与特性が満足する様に適宜決定すれば良いが、一般に

は総量でキャリアに対し、好ましくは0.1~3.0重量%、より好ましくは0.3~2.0重量%であることが良

い。

【0144】本発明に用いられるキャリアの材質として

は、9.8%以上のCu-Zn-Fe(組成比[5~20]:[5~20]:[30~80])の組成からなる

フェライト粒子等が代表的なものであるが、その性能を損なうものでなければ何ら制約のあるものではない。さ

らに結着樹脂、金属酸化物、磁性金属酸化物から構成される樹脂キャリアの如き形態のものであっても構わな

い。

【0145】上述のキャリアとトナー粒子の融合比率は、二成分系現像剤中のトナー濃度として2~9重量

%、好ましくは3~8重量%にすると良好な結果が得られる。トナー濃度が2重量%未満では画像濃度が低く

クリル酸エチルアルミニウムエチルオキシの如き(メタ)アクリル酸エステル系単量体;ブタジエン、イソブレン、シクロヘキセン(メタ)アクリロニトリル、アクリル酸アミドの如きエー系単量体が好ましく用いられる。これら

は、単独または一般的には出版物ポリマーハンドブック第2版1111-p139~192(John Wiley & Sons社)に記載の理論ガラス転移温度(Tg)が、40~80℃を示すように単量体を適宜混合し

て用いられる。理論ガラス転移温度が40℃未満の場合には、トナーの保存安定性や現像剤の耐熱安定性の面から

問題が生じ、一方80℃を超える場合は定着点の上昇をもたらす。特にフルカレートトナーの場合においては各色トナーの着色が不十分となり色再現性に乏しく、更にOHP画像の透明性を著しく低下させ高画質の面から好ま

しくない。

【0135】懸濁重合法を用いてトナー粒子を得る方法においては、重合単量体の重合反応を阻害無く行わせしめるという観点から、極性樹脂を同時に添加するが特に

好ましい。本発明に用いられる極性樹脂としては、ステレンと(メタ)アクリル酸の共重合体、マレイン酸共重合体、ポリエステル樹脂、エポキシ樹脂が好ましく用い

られる。極性樹脂は、単量体と反応しうる不飽和基を分

子中に含まないものが特に好ましい。

【0136】本発明で使用される重合開始剤として、例えば、2,2'-アゾビス(2,2'-アゾビス(2,4,4-ジメチルバレロ

ニトリル)、1'-アゾビス(シクロヘキサ-1-カルボニド

リル)、2,2'-アゾビス(4-メトキシ-2,4-ジメチルバレロ

ニトリル)、アゾビスイソプロピルチオニトリル

の如きアゾ系重合開始剤;ベンゾイルペルオキシド、メ

チルエチルペルオキシド、ジイソプロピルペルオ

キシド、ベンゾイルペルオキシド、ラウロイルペルオ

キシドの如き過酸化化合物重合開始剤が用いられる。

【0137】トナー粒子の粒度分布制御や粒径の制御は、難水溶性の無機塩又は有機コロイド作用をする分散

剤の種類又は添加量を異なる方法、機械的装置条件、例えばローターの周速、パス回数及び攪拌羽根形状の如き

攪拌条件、容器形状、又は水溶液中での固形分濃度を制御する方法により成し遂げることができる。

【0138】本発明においては、シェル部分が重合により

形成された重合体によって形成され、コア部分が低軟化点物質で形成されたコア/シェル構造を有するトナー粒

子であることが、トナーの耐ブロッキング性を低下させることなくトナーの定着性を向上させることができ、さ

らにトナー粒子中からの残存モノマーの除去が容易に行うことができることから好ましい。

【0139】本発明においてトナー粒子の断面形態を観察する具体的方法としては、常温硬化性のエポキシ樹脂中にトナー粒子を十分分散させた後、温度40℃の雰囲気

ン重合する際に副生する低分子量アルキレンポリマーを分離精製したもので、一酸化炭素及び水素からなる合成ガスからアーク法により得られる炭化水素ポリマーの蒸留液分、あるいは、蒸留液を水素添加して得られる合成炭化水素から、特定の成分を抽出分別したポリメチレンワックスが挙げられる。これらワックスには酸化防止剤が添加されている。

【0129】本発明に使用される低軟化点物質は、DSC吸収曲線において、40~90℃(さらに好ましくは45~85℃)の領域に吸熱メインピークを有すること

が好ましい。さらに、吸熱メインピークは、半価幅が10℃以内(より好ましくは5℃以内)であるシャープな

ル特性の低軟化点物質が好ましい。特に、低軟化点物質が炭素数15~45個の長鎖アルキルアルコールと、炭

素数15~45個の長鎖アルキルアルコールとのエステル化合物を主成分とするエステルワックスが、OHP用

シートでの透明性と、定着時の低温度定着性及び耐高温オ

フセット性の点で好ましい。

【0130】本発明において、DSCの測定には、例えばパーキンエレメン社製DSC-7を用いる。装置検出部の温度校正はインジウムと亜鉛の融点を用い、熱量の補正についてはインジウム融解熱を用いる。サンプルは、アルミニウム製バレルを用い対照用(空バレル)で昇

昇温度10℃/min、で20℃から200℃まで昇温し、測定を行った。

【0131】低軟化点物質は、トナー粒子中に結着樹脂100重量部に対して、好ましくは3乃至40重量部、より好ましくは5乃至35重量部含有されていることが良

い。

【0132】低軟化点物質の含有量が5重量部未満の場合には、十分な耐高温オフセット性が得られ難く、さらに記録材の両面への画像定着時に、2回目(裏面)の定着時に1回目(表面)の画像のオフセットが生じることがある。

【0133】低軟化点物質の含有量が40重量部を超え

る場合には、トナーの製造時に粉砕法でトナー粒子を製造する場合には、トナー製造装置内へのトナー成分の酸

着が生じやすく、重合法でトナー粒子を製造する場合に

は、造粒時に遊離性が低下すると共に、トナー粒子同士

の合一が生じ易い。

【0134】本発明において、懸濁重合法によつてトナ

ー粒子を得る場合、係る重合性単量体としては、ステレン、o(m,p)-メチルスチレン、m(p,p)-メチルスチレンの如きスチレン系単量体;(メタ)ア

クリル酸プロピル、(メタ)アクリル酸ブチル、(メタ)アクリル酸オクチル、(メタ)アクリル酸ドデシル、(メタ)アクリル酸ステアチル、(メタ)アクリル酸ベニル、(メタ)アクリル酸2-エチルヘキシル、(メタ)アクリル酸ジメチルアミノエチル、(メタ)ア

持体5aと、表面を覆う弾性層5bよりなる。

【0152】導電性支持体5aとしては、アルミニウム、鉄、銅及びステンレス等の金属や合金、及びカーボン、炭素繊維等を分散した導電性樹脂等を用いることができる。その形状としては円筒状や、円筒の中心に軸を通したもので、円筒の内部に補強を施したものが挙げられる。

【0153】弾性層5bとしては、特に制限されるものではないが、スチレン-ブタジエンゴム、ハイスチレンゴム、ブタジエンゴム、イソブレンゴム、エチレン-ブタジエン共重合体、ニトリル-ブタジエンゴム(NBR)、クロロブレンゴム、ブチルゴム、シリコーンゴム、フッ素ゴム、ニトリルゴム、ウレタンゴム、アクリルゴム、エポキシエポキシド及びノルボルネン系等のエラストマーゴムが好適に用いられる。ポリオレフィン系樹脂、シリコーン樹脂、フッ素系樹脂、ポリカーボネート等の樹脂およびこれらの共重合体や混合物を用いても良い。

【0154】また、弾性層のさらに表面に、潤滑性、はく水性の高い滑剤粉体を任意のバインダー中に分散した表面層を設けても良い。

【0155】滑剤は特に制限はないが、各種フッ素系、シリコン系エラストマー、黒鉛やグラファイトにフッ素を結合したフッ化炭素及びポリテトラフルオロエチレン(PTFE)、ポリフッ化ビニルデン(PVDF)、エチレン-テトラフルオロエチレン共重合体(ETFE)及びテトラフルオロエチレン-パーフルオロアルキルビニルエーテル共重合体(PFA)等のフッ素化合物、シリコーン樹脂粒子、シリコーンゴム、シリコーンエラストマー等のシリコーン系化合物、ポリエチレン(PE)、ポリプロピレン(PP)、ポリスチレン(PS)、アクリル樹脂、ポリアミド樹脂、フェノール樹脂及びエポキシ樹脂等が好ましく用いられる。

【0156】また、表面層のバインダー中に、抵抗を制御するために導電剤を適時添加しても良い。導電剤としては、各種の導電性無機粒子及びカーボンブラック、イオン系導電剤、導電性樹脂及び導電性粒子分散剤等が挙げられる。

【0157】中間転写ドラム5上の多重トナー像は、第2の転写装置8により記録材P上に一括に二次転写されるが、転写手段8としてはコロナ帯電器による非接触静電転写手段又は転写ローラー及び転写ベルトを用いた接触静電転写手段が使用可能である。

【0158】定着装置3としては、加熱ローラー3aと加圧ローラー3bを有する熱ローラー定着装置に替えて、記録材P上のトナー像に接するフィルムを加熱する

ことにより、記録材P上のトナー像を加熱し、記録材Pに多重トナー像を加熱定着するフィルム加熱定着装置を用いることもできる。

【0159】図1に示した画像形成装置が用いている中

間転写体としての中間転写ドラムに代えて、中間転写ベルトを用いて多重トナー像を記録材に一括転写することも可能である。中間転写ベルトの構成について、図8に示す。

【0160】感光ドラム1上に形成拒持されたトナー画像は、感光ドラム1と中間転写ベルト10との中間層部を通過する過程で、一次転写ローラー12から中間転写ベルト10に印加される一次転写バイアスにより形成される電界により、中間転写ベルト10の外周面に順次一次転写される。

【0161】感光ドラム1から中間転写ベルト10への第1〜第4色のトナー画像の順次重量転写のための一次転写バイアスは、トナーとは逆極性で、バイアス電源14から印加される。

【0162】感光ドラム1から中間転写ベルト10への第1〜第3色のトナー画像の一次転写工程において、二次転写ローラー13b及び中間転写ベルトクリッカーナー9は中間転写ベルト10から離間することも可能である。

【0163】13bは二次転写ローラーで、二次転写対向ローラー13aに対応し平行に軸受させて中間転写ベルト10の下面部に離間可能な状態に配置されている。

【0164】中間転写ベルト10上に転写された合成カラートナー画像の転写材Pへの転写は、二次転写ローラー13bが中間転写ベルト10に当接されると共に、中間転写ベルト10と二次転写ローラー13bとの当接二重に所定のタイミングで転写材Pが給送され、二次転写バイアスがバイアス電源16から二次転写ローラー13bに印加される。この二次転写バイアスにより中間転写ベルト10から転写材Pへ合成カラートナー画像が二次転写される。

【0165】転写材Pへの画像転写終了後、中間転写ベルト10にはクリーニング用帯電部材9が当接され、感光ドラム1とは逆極性のバイアスをバイアス電源15から印加することにより、転写材Pに転写されずに中間転写ベルト10上に残留しているトナー(転写残トナー)に感光ドラム1と逆極性の電荷が付与される。

【0166】前記転写残トナーは、感光ドラム1とのニップ部およびその近傍において感光ドラム1に静電的に転写されることにより、中間転写体がクリーニングされる。

【0167】中間転写ベルトは、ベルト形状の基層と基層の上に設けられる表面処理層よりなる。なお、表面処理層は複数の層により構成されていても良い。

【0168】基層及び表面処理層には、ゴム、エラストマー、樹脂を使用することができ、例えばゴム、エラストマーとしては、天然ゴム、イソブレンゴム、スチレン-ブタジエンゴム、ブタジエンゴム、ブチルゴム、エチレン-プロピレンゴム、エチレン-プロピレン-ブタジエン三元共重合体、クロロブレンゴム、クロロホルン化ポリエチレン、塩素化ポリエチレン、アクリロニトリル-ブタジエン

ンゴム、ウレタンゴム、シリオキサタック1, 2-ポリリブタジエン、エピクロヒドリンゴム、アクリルゴム、シリコーンゴム、フッ素ゴム、多硫化ゴム、ポリノルボルネンゴム、水素化ニトリルゴム及び熱可塑性エラストマー(例えばポリスチレン系、ポリオレフィン系、ポリ塩化ビニル系、ポリウレタン系、ポリアミド系、ポリエステル系及びフッ素樹脂系)等からなる群より選ばれる。ただし、上記材料に限定されるものではない。また、樹脂としては、ポリオレフィン系樹脂、シリコーン樹脂、フッ素系樹脂、ポリカーボネート等の樹脂を使用することができ、これら樹脂の共重合体や混合物を用いても良い。

【0169】基層としては上述のゴム、エラストマー、樹脂をフィルム状にして使用することができ、また、これらの物質を、縞布形状、不縞布形状、糸状、フィルム形状をした芯体層の片面あるいは両面に上述のゴム、エラストマー、樹脂を被覆、浸漬、噴霧したものを使用しても良い。

【0170】芯体層を構成する材料は、例えば綿、絹、麻及び羊毛等の天然繊維；キチン繊維、アルギン酸繊維及び再生セルロース繊維等の再生繊維；アセトセルロース等の半合成繊維；ポリエステル繊維、ナイロン繊維、アクリル繊維、ポリオレフィン繊維、ポリビニルアルコール繊維、ポリ塩化ビニル繊維、ポリ塩化ビニリデン繊維、ポリウレタン繊維、ポリアクリル系ポリオキシベンゾエーテル繊維、ポリセタセター繊維、アラミド繊維、ポリフロロエチレン繊維及びフェノール繊維等の合成繊維；炭素繊維、硝子繊維及びボロン繊維等の無機繊維；鉄線、銅線及び銅合金等の金属繊維からなる群より選ばれる1種あるいは2種以上を用いることができる。もちろん、上記材料に限定されるものではない。

【0171】さらに、中間転写体の抵抗値を調節するために基層および表面処理層中に導電剤を添加しても良い。導電剤としては特に限定されるものではないが、例えば、カーボン、アルミニウムやニッケル等の金属粉末、含有有ポレタクリル酸メチル、ポリビニルアルコール、ポリビニルピロール、ポリジアセチレン、ポリエチレンイミン、含硫素系分子化合物及びポリビロール等の導電性高分子化合物；等からなる群より選ばれる1種あるいは2種以上を用いることができる。ただし、上記導電剤に限定されるものではない。

【0172】また、中間転写体表面の滑り性を上げ、転写性を向上するために必要に応じて滑剤を添加しても良い。

【0173】滑剤は特に制限はないが、各種フッ素系、シリコン系エラストマー、黒鉛やグラファイトにフッ素を結合したフッ化炭素及びポリテトラフルオロエチレン(PTFE)、ポリフッ化ビニルデン(PVDF)、エ

チレン-テトラフルオロエチレン共重合体(ETFE)及びテトラフルオロエチレン-パーフルオロアルキルビニルエーテル共重合体(PFA)等のフッ素化合物；シリコーン樹脂、シリコーンゴム、シリコーンエラストマー等のシリコーン系化合物；ポリエチレン(PE)；ポリプロピレン(PP)；ポリスチレン(PS)；アクリル樹脂；ポリアミド樹脂；フェノール樹脂；及びエポキシ樹脂；等が好ましく用いられる。

【0174】次に、複数画像形成部にて各色のトナー画像をそれぞれ形成し、これを同一転写材に順次重ねて転写するようにした画像形成方法を図2をもとに説明する。

【0175】ここでは、第1、第2第3および第4の画像形成部29a、29b、29c、29dが並設されており、各画像形成部はそれぞれ専用の静電層保持体、いわゆる感光ドラム19a、19b、19c、19dおよび19dを具備している。

【0176】感光ドラム19a乃至19dはその外周面に静電層形成手段23a、23b、23c、23dおよび23d、現像部17a、17b、17c、17dおよび17d、転写用放電部24a、24b、24c、24dおよび24d、ならびにクリーニング部18a、18b、18c、18dおよび18dが配置されている。

【0177】このような構成にて、まず、第1画像形成部29aの感光ドラム19a上に静電層形成手段23aによって原稿画像における、例えばイエロー成分色の静電層が形成される。該静電層は現像手段17aのエロートナーを有する現像剤で可視画像とされ、転写部24aにて、転写材としての記録材Sに転写される。

【0178】上記のようにイエロー画像が転写材Sに転写されている間に、第2画像形成部29bではマゼンタ成分色の静電層が感光ドラム19b上に形成され、続いて現像手段17bのマゼンタトナーを有する現像剤で可視画像とされる。この可視画像(マゼンタトナー像)は、上記の第1画像形成部29aでの転写が終了した転写材Sが転写部24bに搬入されるときに、該転写材Sの所定位置に重ねて転写される。

【0179】以下、上記と同様な方法により第3、第4の画像形成部29c、29dによってシアン色、ブラウン色の画像形成が行われ、上記同一の転写材Sに、シアン色、ブラウン色を重ねて転写するのである。このようにな画像形成プロセスが終了したならば、転写材Sは定着部22に搬送され、転写材S上の画像を定着する。これによって転写材S上には多色画像が得られるのである。転写が終了した感光ドラム19a、19b、19c、19dおよび19dはクリーニング部18a、18b、18c、18dおよび18dにより残留トナーを除去され、引き続き行われる次の画像形成のために供せられる。

【0180】なお、上記画像形成装置では、転写材としての記録材Sの搬送のために、搬送ベルト25が用いら

れており、図2において、転写材Sは右側から左側へ搬送され、その搬送過程で、各画像形成部29_a、29_b、29_c、および29_dにおける各転写部24_a、24_b、24_c、および24_dを通して、転写をうける。

【0181】この画像形成方法において、転写材を搬送する搬送手段として加工の容易性及び耐久性の観点から、テトロン繊維のメッシュを用いた搬送ベルトおよびポリエチレンテトラフルオエチレン系樹脂、ポリイミド系樹脂、ウレタン系樹脂の如き薄い誘電体シートを用いた搬送ベルトが利用される。

【0182】転写材Sが第4画像形成部29_dを通過すると、AC電圧が除電部20に加えられ、転写材Sは除電され、ベルト25から分離され、その後、定電部22に入り、画像定電され、排出口26から排出される。

【0183】なお、この画像形成方法では、その画像形成部にそれぞれ独立した静電潜像保持体を具備しておき、転写材はベルト式の搬送手段で、順次、各静電潜像保持体の転写部へ送られるように構成してよい。

【0184】また、この画像形成方法では、その画像形成部に共通する静電潜像保持体を具備してなり、転写材は、ドラム式の搬送手段で、静電潜像保持体の転写部へ搬送し送られて、各色の転写をうけるように構成してもよい。

【0185】しかしながら、この搬送ベルトでは、体積抵抗が高いため、カラー画像形成装置におけるように、数回の転写を繰り返す過程で、搬送ベルトが帯電量を増加させて行く。このため、各転写の都度、転写電流を順次増加させないと、均一な転写を維持できない。

【0186】本発明トナーは転写性が優れているので、転写を繰り返す毎に搬送手段の帯電が増しても、同じ転写電流で各転写におけるトナーの転写性を均一化でき、良質な高品位画像が得られることになる。

【0187】更に他の実施形態のフルカラー画像を形成するための画像形成方法を図3に基づいて説明する。

【0188】感光ドラム33上に適当な手段で形成された静電潜像は、矢印の方向へ回転する回転現象ユニット39に取り付けられた現像手段としての現像器36中の第1の現像剤により可視化される。感光ドラム33上のフルカラー画像は、グリッター47によって転写ドラム48上に保持されている転写材としての配材Sに、転写帯電器44により転写される。転写後に感光ドラム33の表面上に残存する転写残トナーは、感光ドラム33の表面に塗着するクリーニングブレードによりクリーニング38で回収され、感光ドラム33はクリーニングされる。

【0189】転写帯電器44には、コロナ帯電器又は接触帯電器が利用され、転写帯電器14にコロナ帯電器が使われる場合には、 $-10\text{ kV} \sim +10\text{ kV}$ の電圧が印加され、転写電流は $-500\text{ }\mu\text{A} \sim +500\text{ }\mu\text{A}$ であり、転写ドラム48の外周面には保持部材が設けられ、

【0190】一方、転写電流を高くすると、転写画像を私すので好ましくない。ところが本発明のトナーは転写性に優れているので、多重転写する際の色目、三色目、四色目と画面の面積もきちんと形成され、めりはりの利

【0191】更に三色目、四色目も同様に得られる。このように転写ドラム48は転写材としての配材Sを把持したまま所定回数だけ回転し所定色数のトナー像が多重転写される。静電転写するための転写電流は、一色目<二色目<三色目<四色目の順に高めることが感光ドラム上に残る転写残トナーを少なくするために好ま

よれば現像器中の現像剤が像形成体の表面を撫ることになり、2回目以降の現像工程において先行の現像工程で形成された像を私すことなく現像を行うことができる。

【0196】感光ドラム103上に形成された多色多重画像、フルカラー画像は転写帯電器109により転写材としての配材Sに転写される。転写工程においては、静電転写方法が好ましく用いられ、コロナ放電転写方法又は接触転写方法が利用される。コロナ放電転写方法は、転写材としての配材Sを介しコロナ放電を生じさせ、転写帯電器109を像に対向するように配置し、転写材としての配材Sの背面からコロナ放電を作用させ、静電的に転写する方法である。接触転写方法とは、転写材としての配材Sを介し、転写ローラー、転写ベルトを像形成体に接触させてローラーにバイアスを印加させるか、ベルトの背面から静電的に転写する方法である。

この静電転写方法により感光ドラム103の表面に担持された多色トナー像が一括して転写材としての配材Sに転写される。このような一括転写方式では、転写するトナー量が多いので、転写残量が多くなり、転写ムラが発生しやすくなる。フルカラー画像においては色ムラを生じやすくなる。

【0197】しかしながら本発明のトナーは転写性に優れており、多色画像においてはどの色もきちんと形成される。フルカラー画像においては色再現性に優れた美しい画像が得られる。さらに、低電流でも転写効率が良いので、転写時における画像の乱れを少なくすることができ、更に、分離も容易になるので、分離時の画像の乱れトナー飛散も低減できる。さらに、転写性にも優れるので接触転写手段においても良好な転写性を示す。したがって、本発明のトナーは、多重現像一括転写工程を有する画像形成体にも好ましく用いられる。

【0198】多色トナー像が一括転写された配材Sは、感光ドラム103から分離され転写ローラー定電器112で定電されることにより多色画像となる。

【0199】転写後に感光ドラム103の表面上に残存する転写残トナーは、感光ドラム103の表面に当接可能に配置されているクリーニングブレードを有するクリーニングローラー108で回収され、感光ドラム103はクリーニングされる。このクリーニングローラー108のクリーニングブレードは、通常は感光ドラム103の表面と離間しており、感光ドラム103から転写材としての配材Sに転写が行われる際に感光ドラム103の表面に当接するように移動するものである。

【0200】図5は、中間転写ドラムを用いた中間転写ドラム上に一次転写された4色のカラートナー画像を配材材に一括して二次転写する際の二次転写手段として、転写ベルトを用いた画像形成装置の説明図である。

【0201】図5に示す装置システムにおいて、現像器244-1、244-2、244-3、244-4に、

それぞれシアントナーを有する現像剤、マゼンタトナーを有する現像剤、イエロートナーを有する現像剤及びブラックトナーを有する現像剤が導入され、感光体241に形成された静電潜像を現像し、各色トナー像が感光体241上に形成される。感光体241はa-Se、CdS、ZnO、OPC、a-Siの様な光導電絶縁物質を持つ感光ドラムもしくは感光光導電絶縁物質層を有する感光ドラムと見做すことができる。感光体241は図示しない駆動装置によって矢印方向に回転する。

【0202】感光体241としては、アモルファスシリコン感光層、又は有機系感光層を有する感光体が好ましく用いられる。

【0203】有機感光層としては、感光層が電荷発生物質及び電荷輸送性を有する物質を同一層に含有する、単一層型でもよく、又は、電荷輸送層を電荷発生層と分とする機能分離型感光層であっても良い。導電性基板上に電荷発生層、次いで電荷輸送層の順で積層されている構造の複層型感光層は好ましい例の一つである。

【0204】有機感光層の結着樹脂はポリカーボネート樹脂、ポリエスチル樹脂、アクリル系樹脂が特に、転写性、クリーニング性が良く、クリーニング不良、感光体へのトナーの融着、外周部のフィルムミリングが起こりにくい。

【0205】帯電工程では、コロナ帯電器を用いる感光体241とは非接触である方式と、ローラー等を用いる接触型の方式がありいずれのものも用いる。効率的な均一帯電、シンブル化、低オゾン発生化のために図5に示す如く接触方式のものが好ましく用いられる。

【0206】帯電ローラー242は、中心の芯金242bとその外周を形成した導電性弾性層242aとを基本構成とするものである。帯電ローラー242は、感光体241面に押圧力をもって圧接され、感光体241の回転に伴い従動回転する。

【0207】帯電ローラーを用いた時の好ましいプロセス条件としては、ローラーの当接圧が $5 \sim 500\text{ g/cm}^2$ 、直流電圧に交流電圧を重ねたものを用いた時には、交流電圧は $0.5 \sim 5\text{ kVp}$ 、交流周波数は $50\text{ Hz} \sim 5\text{ kHz}$ 、直流電圧は $\pm 0.2 \sim \pm 1.5\text{ kV}$ であり、直流電圧を用いた時には、直流電圧は $\pm 0.2 \sim \pm 5\text{ kV}$ である。

【0208】その他の帯電手段としては、帯電ブレードを用いる方法や、導電性ブラシを用いる方法がある。これららの接触帯電手段は、高電圧が必要になったり、オゾンの発生が低減するといった効果がある。

【0209】接触帯電手段としての帯電ローラー及び帯電ブレードの材質としては、導電性ゴムが好ましく、その表面に導電性被膜をもうけても良い。導電性被膜としては、ナイロン系樹脂、PVDF（ポリフッ化ビニリデン）、PVC（ポリ塩化ビニリデン）などが適用可能である。

重合体 (B P D M) 等の体積抵抗 $1.0^6 \sim 1.0^{10} \Omega \cdot \text{cm}$ 程度の弾性体でつくられている。芯金 247a2 は安定電圧値によりバイアスが印加されている。バイアス条件としては、 $\pm 0.2 \sim \pm 1.0 \text{ kV}$ が好ましい。

【0222】 次いで転写材 246 は、ハロゲンヒータ等の発熱体を内蔵させた加熱ローラーとこれと押圧力をもつて圧接した弾性層の加熱ローラーとを基本構成とする定規路 281 に搬送され、加熱ローラーと加熱ローラー間を通過することによってトナー像が転写材に加熱加圧定着される。フィルムを介してヒータにより定着する方法を用いても良い。

【0227】 上記の図 1乃至図 5 に示す現像装置 (現像器) には、一成分系現像剤を用いる一成分系現像剤とトナー及びキャリアを有する二成分系現像剤を用いる二成分系現像剤とが適用できる。

【0228】 非磁性トナーとして、本発明のトナーを有する一成分系非磁性現像剤を用いる現像方法を図 6 に示す。図 6 に示す現像装置に基いて説明する。

【0229】 現像装置 170 は、非磁性トナーとしての非磁性一成分系現像剤 176 を収容する現像容器 171、現像容器 171 に収容されている一成分系非磁性現像剤 176 を担持し、現像領域に搬送するための現像剤担持体 172、現像剤担持体上に一成分系非磁性現像剤を供給するための供給ローラー 173、現像剤担持体上の現像剤層を規制するための現像剤層厚規制部材としての弾性ブレード 174、現像容器 171 内の一成分系非磁性現像剤 176 を攪拌するための攪拌部材 175 を有している。

【0230】 169 は静電潜像を担持するための潜像担持体であり、潜像形成は図示しない電子写真プロセス手段または静電潜像手段によりなされる。172 は現像剤担持体としての弾性スリーブであり、アルミニウムあるいはステンレスからなる非磁性スリーブからなる。

【0231】 現像スリーブは、アルミニウム、ステンレスの粗さをそのまま用いてもよいが、好ましくはその表面をガラスビーズで吹きつけて均一に荒らしたもののや、鏡面処理したもの、あるいは樹脂でコートしたものが多い。なかでも、スリーブ表面を樹脂でコートする方法は、樹脂中に各種粒子を分散させることで、スリーブ表面荒さや弾性を調整することや、スリーブ表面に弾性を付与することが簡便に行えるため、好適に用いられる。

【0232】 スリーブ表面をコートするのには、樹脂および樹脂に添加される各種粒子については特に限定されるものではないが、樹脂としてはステンレス系樹脂、ビニール系樹脂、ポリエーテルオキサイド樹脂、ポリカーボネート樹脂、ポリフエニールオキサイド樹脂、ポリアミド樹脂、ブツ系樹脂、線維系樹脂、アクリル系樹脂等の熱可塑性樹脂、エポキシ樹脂、ポリエステル樹脂、アルキッド樹脂、フェノール樹脂、メラミン樹脂、

き付きを防止することができる。特に中間転写体の弾性層の体積固有抵抗値が転写ローラーの弾性層の体積固有抵抗値より 10 倍以上であることが特に好ましい。

【0219】 中間転写ドラム及び転写ローラーの硬度は、JIS K-6301 に準拠し測定される。本発明に用いられる中間転写ドラムは、10~40 度の範囲に属する弾性層から構成されることが好ましく、一方、転写ローラーの弾性層の硬度は、中間転写ドラムの弾性層の硬さより硬く 41~80 度の値を有するものが中間転写ドラムへの転写材の巻き付きを防止する上で好ましい。

【0220】 図 5 では中間転写ドラム 245 の下方に、転写ローラー側に凹部が形成され、中間転写ドラムへの転写材の巻き付きが発生しやすい。

【0221】 図 5 では中間転写ドラム 245 の軸に対して並行に配置された 2 本のローラー、すなわちバイアスローラー 247a とテンションローラー 247c に掛け渡されてお

り、駆動手段 (不図示) によって駆動される。転写ローラー 247b は、テンションローラー 247c を中心にし、中間転写ドラム 245 の軸に対して並行に配置された 2 本のローラー、すなわちバイアスローラー 247a とテンションローラー 247c に掛け渡されてお

り、駆動手段 (不図示) によって駆動される。転写ローラー 247b は、テンションローラー 247c を中心にし、中間転写ドラム 245 の軸に対して並行に配置された 2 本のローラー、すなわちバイアスローラー 247a とテンションローラー 247c に掛け渡されてお

り、駆動手段 (不図示) によって駆動される。転写ローラー 247b は、テンションローラー 247c を中心にし、中間転写ドラム 245 の軸に対して並行に配置された 2 本のローラー、すなわちバイアスローラー 247a とテンションローラー 247c に掛け渡されてお

り、駆動手段 (不図示) によって駆動される。転写ローラー 247b は、テンションローラー 247c を中心にし、中間転写ドラム 245 の軸に対して並行に配置された 2 本のローラー、すなわちバイアスローラー 247a とテンションローラー 247c に掛け渡されてお

り、駆動手段 (不図示) によって駆動される。転写ローラー 247b は、テンションローラー 247c を中心にし、中間転写ドラム 245 の軸に対して並行に配置された 2 本のローラー、すなわちバイアスローラー 247a とテンションローラー 247c に掛け渡されてお

り、駆動手段 (不図示) によって駆動される。転写ローラー 247b は、テンションローラー 247c を中心にし、中間転写ドラム 245 の軸に対して並行に配置された 2 本のローラー、すなわちバイアスローラー 247a とテンションローラー 247c に掛け渡されてお

【0210】 感光体上のトナー像は、電圧 (例えば、 $\pm 0.1 \sim \pm 5 \text{ kV}$) が印加されている中間転写ドラム 245 に転写される。転写後の感光体表面は、グリーンンググレート 248 を有するグリーンンググレート 249 でグリーンングされる。

【0211】 中間転写ドラム 245 は、バイアスの導電性芯金 245b と、その外周面に形成した中抵抗の弾性層 245a からなる。芯金 245b は、プラスチックのバイブに導電性メンキをほどこしたものである。

【0212】 中抵抗の弾性層 245a は、シリコンゴム、テフロンゴム、クロロブレンジウム、クレタング、E P D M (エチレンプロピレンジエンの 3 元重合体) などの弾性材料に、カーボンブラック、酸化亜鉛、酸化スズ、炭化ケイ素の如き導電性付与材を配合分散し、電気抵抗値 (体積抵抗率) を $1.0^5 \sim 1.0^{11} \Omega \cdot \text{cm}$ の中抵抗に調整した、ソリッドあるいは発泡肉質の層である。

【0213】 中間転写ドラム 245 は感光体 241 に対して並行に搬送されて感光体 241 の下面部に接触させて配設されており、感光体 241 と同じ周速度で矢印の反時計方向に回転する。

【0214】 感光体 241 の面に形成担持された第 1 色のトナー像が、感光体 241 と中間転写ドラム 245 とが接する転写ニップ部を通過する過程で中間転写ドラム 245 に対する印加転写バイアスで転写ニップ部形成された電界によって、中間転写ドラム 245 の外面に対して順次に中間転写されていく。

【0215】 必要により、着脱自在なグリーンング手段 280 により、転写後のトナー像の転写後に、中間転写ドラム 245 の表面がグリーンングされる。中間転写ドラム上にトナー像がある場合、トナー像を乱さないようにグリーンング手段 280 は、中間転写体表面から離される。

【0216】 中間転写ドラム 245 に対して並行に搬送させ、中間転写ドラム 245 の下面部に接触させて転写手段が配設され、転写手段 247 は例えば転写ローラー又は転写ベルトであり、中間転写ドラムと同じ周速度で矢印の時針方向に回転する。転写手段は直接中間転写ドラムと接触するように配設されていても良く、また、ベルト等が中間転写ドラムと転写手段との間に接触するよう配置されても良い。

【0217】 転写ローラーの場合、中心に芯金とその他の周を形成した導電性弾性層とを基本構成とするものである。

【0218】 中間転写ドラム及び転写ローラーとして、一般的な材料を用いることが可能である。中間転写ドラムの弾性層の体積固有抵抗値よりも転写ローラーの弾性層の体積固有抵抗値をより小さく設定すること転写ローラーへの印加電圧が軽減でき、転写材上に良好なトナー像を形成できると共に転写材の中間転写体への巻

ポリウレタン樹脂、尿素樹脂、シリコーン樹脂及びポリイミド樹脂等の熱硬化性は光硬化性樹脂が好適に用いられる。

【0233】 また、添加する各種粒子としては P M M A、アクリル樹脂、ポリプロピレン樹脂、ポリスチレン樹脂、ポリエチレン、ポリブタジエン、ポリブタジエン、又はこれらの共重合体、ペンゾグアミン樹脂、フエノール樹脂、ポリアミド樹脂、ナイロン、フッ素樹脂、シリコーン樹脂、エポキシ系樹脂、ポリエステル樹脂等の樹脂粒子；フッ素系ブラック、ラングブラック、サマーブラック、アセチレンブラック、チタネブラック等のカーボンブラック；酸化チタン、酸化チタン、酸化亜鉛、酸化モリブデン、チタン酸カリ、酸化アルミニウム及び酸化インジウム等の金属、グラファイト、金、銅、銀及びニッケル等の金属、グラファイト、金、銅、銀及び炭素繊維等の無機系充填剤が好適に用いられる。

【0234】 一成分系非磁性現像剤 176 は現像容器 171 に貯蔵されており、供給ローラー 173 によって現像剤担持体 172 上に供給される。供給ローラー 173 はポリウレタンフォームの如き発泡材より成っており、現像剤担持体に対して、順次は逆方向に 0 でない相対速度をもつて回転し、現像剤の供給とともに、現像剤担持体 172 上の現像後の現像剤 (未現像現像剤) のはぎ取りも行っている。現像剤担持体 172 上に供給された二成分系非磁性現像剤は現像剤層厚規制部材としての弾性ブレード 174 によって均一かつ薄層に塗布される。

【0235】 弾性塗布ブレードと現像剤担持体との当接圧力は、現像スリーブ母線方向の線圧として $0.3 \sim 2.5 \text{ kg/cm}$ 、好ましくは $0.5 \sim 1.2 \text{ kg/cm}$ が有効である。当接圧力が 0.3 kg/cm より小さい場合、一成分系非磁性現像剤の均一塗布が困難となり、一成分系非磁性現像剤の帯電量分布がブロードとなりカブリや散状の原因となる。当接圧力が 2.5 kg/cm を超えると、一成分系非磁性現像剤に大きな圧力が加わり、一成分系非磁性現像剤が劣化するため、一成分系非磁性現像剤の凝集が発生するなど好ましくない。また、現像剤担持体は駆動させるために大きなトルクを要するため好ましくない。即ち、当接圧力を $0.3 \sim 2.5 \text{ kg/cm}$ に調整すること、本発明のトナーを用いた一成分系非磁性現像剤の凝集を効果的に低減することが可能になり、さらに一成分系非磁性現像剤の帯電量を同時に立ち上げることが可能になる。

【0236】 弾性ブレードとしては、シリコーンゴム、ウレタンゴム、NBR の如きゴム弾性体；ポリエチレン、テフロン、ポリアミドの如きエラストマー；ステンレス、銅、リン青銅の如き金属弾性体が使用でき、さらにそれらの複合体であっても使用できる。好ましくは、バネ弾性を有する SUS またはリン青銅の金属弾性板の上にウレタン、シリコーン等のゴム材料やポリアミドエ

補給される。

【0244】 現像室R₁内には搬送スクリーン124が設けられており、この搬送スクリーン124の回転駆動によって現像室R₁内の現像剤128は、現像スリーブ121の長手方向に向けて搬送される。同様に、貯蔵室R₂内には搬送スクリーン125が設けられ、搬送スクリーン125の回転によって、補給口131からの長手方向に沿って搬送する。

10. 【0245】 現像剤128は、非磁性トナーと磁性キャリアとを有した二成分系現像剤である。

【0246】 現像剤126の感光ドラム119に近接する部位には開口部が設けられ、該開口部から現像スリーブ121が外部に突出し、現像スリーブ121は、バイアス電圧ドラム119との間には間隙が設けられている。非磁性材にて形成される現像スリーブ121には、バイアスを印加するためのバイアス印加手段132が配置されている。

【0247】 スリーブ基板122に固定された磁界発生手段としてのマグネットローラー、即ち磁石123は、上述のように、現像磁石S₁とその下流に位置する磁石N₃と、現像剤128を搬送するための磁石N₂、S₂、N₁とを有する。磁石123は、現像磁石S₁が感光ドラム119に対向するようにスリーブ基板122内に配置されている。現像磁石S₁は、現像スリーブ121と感光ドラム119との間の現像剤の近傍に磁界を形成し、該磁界によって磁気ブラシが形成される。

【0248】 現像スリーブ121の上方に配置され、現像スリーブ121上の現像剤128の層厚を規制する現像剤規制ブレード127は、アルミニウム、SUS16の如き非磁性材料で作製される。非磁性ブレード127の端部と現像スリーブ121面との距離Aは300〜1000μm、好ましくは400〜900μmである。この距離Aが300μmより小さいと、磁性キャリアがこの間につまみ現像剤層にムラを生じやすいと共に、良好な現像を行うのに必要な現像剤を散布することができず、過度の薄いムラの多い現像画像しか得られないという問題点がある。現像剤中に存在している不用品粒子による不均一散布（いわゆるブレードづまり）を防止するためには、400μm以上が好ましい。距離Aが1000μmより大きいと現像スリーブ121上へ散布される現像剤量が増加し所定の現像剤層厚の規制が行われず、感光ドラム119への磁性キャリア粒子の付着が多くなると共に現像剤の乾燥、非磁性の現像剤層及び規制ブレード127による現像剤剥離力が弱まりトナーのトリガが不足しカブリやすくなるという問題点がある。

【0249】 この二成分系現像剤120の現像は、交番電界を印加しつつ、トナーと磁性キャリアとにより、構成される磁気ブラシを像担持体（例えば、感光ドラム119）に接触している状態で行う。この磁気

【0255】 上記の二成分系現像剤を用いた現像方法は、転写後に感光体ドラム上に残存する転写残トナーを、転写工程における転写部と帯電工程における帯電部との間及び帯電部と現像工程における現像部との間に、感光体ドラムの表面に当接するクリーニング部材を設けずに、現像工程において現像磁石が回収する現像剤同時クリーニングを行うことができる。

【0256】 現像同時クリーニング方式においては、像担持体の移動方向に対して、現像部、転写部及び帯電部の順で位置しており、転写部と帯電部との間及び帯電部と現像部との間に、像担持体の表面に当接して帯電部と現像部との間に、像担持体の表面に当接して帯電部と現像部との間に存在する転写残トナーを除去するためのクリーニング部材を有していない。

【0257】 現像同時クリーニング方式を用いた現像方法について、現像工程において、トナーの帯電極性（帯電極性の帯電極性の帯電極性が同極性で現像を行）う反転現象を例に挙げて説明すると、マイナスイオンが感光体及びマイナスイオン帯電性のトナーを用いた場合、その転写工程において、プラス極性の転写部材によって可視化された像を転写部材に転写することになるが、転写部材の種類（厚み、抵抗、誘電率の違い）と画像面積の関係により、転写残のトナーの帯電極性がプラスからマイナ

スまで変動する。しかし、マイナスイオン帯電性の感光体を帯電する際のマイナスイオン極性の帯電部材により、感光体表面と共に転写残のトナーまでもが、転写工程においてプラス極性に帯電していたとしても、一様にマイナスイオン帯電性を帯電することが出来る。それゆえ、現像時に一様にマイナスイオン帯電したトナー粒子が感光体表面に存在している。現像方法として反転現象を用いた場合、マイナスイオンに帯電された転写残のトナーは、トナーの現像されるべき明部電位には残らず、現像電界の電位上、現像剤の磁気ブラシは現像剤担持体の方に引き寄せられ、残留しない。

【0258】 次に本発明の装置ユニットについて図6を用いて説明する。

【0259】 本発明の装置ユニットは、画像形成装置本体（例えば、複写機、レーザービームプリンター、ファクシミリ装置）に設け可能に装着される。

【0260】 図6に示した実施形態では、装置ユニットは、現像装置170であり、現像装置170が画像形成装置本体に設け可能に装着される。

【0261】 従って、装置ユニットとしては、現像剤176、現像剤171、現像剤担持体172、供給ローラ173、現像剤規制部材174及び現像部材175を有するものであるが、本発明の装置ユニットとしては、少なくとも現像剤176、現像剤171及び現像剤担持体172を有していれば良い。

【0262】 さらに装置ユニットとしては、像担持体、クリーニング部材又は帯電部材を一体に有してい

ラストマー等の各種エラストマーを射出成型して設けたものが良い。

【0237】 この非磁性二成分系現像剤において、ブレードにより現像スリーブ上に二成分系非磁性現像剤を薄層コートする系においては、十分な画像精度を得るために、現像スリーブ上の二成分系非磁性現像剤の厚さを、現像スリーブと像担持体との対向間隙αよりも小さくし、この間隙に交番電界を印加することが好ましい。すなわち図8に示すバイアス電源により、現像スリーブ172と像担持体169との間に交番電界または交番電場を印加し、現像スリーブ172の表面にバイアスを印加することにより、現像スリーブ上から像担持体上への二成分系非磁性現像剤の移動を容易にし、更に良好な画像を得ることが出来る。

【0238】 本発明においては、像担持体と現像剤担持体との間隙αは、例えば50〜500μmに設定され、現像剤担持体上に担持される現像剤層の厚さは、例えば40〜400μmに設定されることが好ましい。

【0239】 現像スリーブは像担持体に対し、100〜200%の周速で回転される。交番バイアス電圧は、ピーク電圧で0.1kV以上、好ましくは0.2〜3.0kV、更に好ましくは0.3〜2.0kVで用いられる。交番バイアス周波数は、1.0〜5.0kHz、好ましくは1.0〜3.0kHz、更に好ましくは1.5〜3.0kHzで用いられる。交番バイアス電圧は、矩形波、サイン波、のこぎり波、三角波の如き波形が適用できる。さらに、正、逆の電圧、時間の異なる非対称交流バイアスも利用できる。直流バイアスを重畳するのも好ましい。

【0240】 次に非磁性トナーとしての本発明のトナーとキャリアとから構成される二成分系現像剤を用いた方法を図1に示す部材構成図に基づいて説明する。

【0241】 現像装置120は、二成分系現像剤128を収納する現像剤126、現像剤126に収納されている二成分系現像剤128を担持し、現像剤に搬送するための現像剤担持体としての現像スリーブ121、現像スリーブ121上に形成される現像剤層の厚さを規制するための現像剤層厚規制手段としての現像ブレード127を有している。

【0242】 現像スリーブ121は、非磁性のスリーブ基板122内にマグネット123を内包している。

【0243】 現像装置126の内包は、隔壁130によって現像室（第1室）R₁と像槽室（第2室）R₂と区画され、像槽室R₂の上方には隔壁130を隔ててトナー貯蔵室R₃が形成されている。現像室R₁及び像槽室R₂内には現像剤128が収容されており、トナー貯蔵室R₃内には補給用トナー（非磁性トナー）129が収容されている。なお、トナー貯蔵室R₃には補給口131が設けられ、補給口131を経て消費されたトナーに見合った量の補給用トナー129が像槽室R₂内に落下

イース電圧として+300Vの直流電圧を印加した。
 【0294】二次転写条件：中間転写体5上に二次転写されたトナー画像を記録材Pに二次転写するため、転写手段8に二次転写バイアスとして+2000Vの直流電圧を印加した。

【0295】評価は、初期及び各耐久枚数での画像濃度を測定し、得られた数値の相対平均値を初期画像の濃度と定めた。
 【0296】評価は、初期及び各耐久枚数での画像濃度を測定し、得られた数値の相対平均値を初期画像の濃度と定めた。

【0297】これを3回行い、合計30枚の画像濃度を測定し、得られた数値の相対平均値を初期画像の濃度と定めた。
 【0298】上記評価の方法を用い、印刷枚数が1000枚時、3000枚時、及び5000枚時の画像について、同様の方法で各耐久枚数での画像濃度の評価を行った。

【0299】ベタ画像の画像濃度安定性
 温度20℃、湿度30%の環境において全ベタ画像を1枚印刷し、得られた全ベタ画像から無作為に選んだ10枚の画像濃度を反転式濃度計(TOKYODENSHOKU CO., LTD 社製 REFLECTOMETER ODEL TC-6DS)を用いて測定した。

【0297】これを3回行い、合計30枚の画像濃度を測定し、得られた数値の相対平均値を初期画像の濃度と定めた。
 【0298】上記評価の方法を用い、印刷枚数が1000枚時、3000枚時、及び5000枚時の画像について、同様の方法で各耐久枚数での画像濃度の評価を行った。

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【0300】これを3回行い、合計30枚の画像濃度を測定し、得られた数値の最大値と最小値の差を計算して以下のようその程度を表記した。
 a：最大値と最小値の差が0.2以下
 b：最大値と最小値の差が0.2以下
 c：最大値と最小値の差が0.4以下
 d：最大値と最小値の差が0.6以下
 e：最大値と最小値の差が0.8以下

【0301】上記評価において、最大値と最小値の差が小さいほど、初期画像にかすれやアラがなく、画像濃度安定性に優れた良好な画像である。

【0302】上記の評価を印刷枚数が1000枚時、3000枚時、及び5000枚時の画像についても、同様の方法で各耐久枚数でのベタ画像の画像濃度安定性の評価を行った。

【0303】紙上カブリ量
 記録材として市販のCLCペーパーA4(キヤノン販売 社販売、重量：81.4g/m²)を用いてベタ白画像部を有する画像をプリントし、反転式濃度計(TOKYO DENSHOKU CO., LTD 社製 REFLECTOMETER ODEL TC-6DS)を用いてプリント後のベタ白部の反転濃度とプリント用の紙

の反転濃度を測定した。
 【0304】プリント後の白地部反転濃度最悪値(Ds)とプリント前の用紙の反転濃度平均値(Dr)の差(Ds-Dr)を紙上カブリ量とした。

【0305】紙上カブリ量2%以下は実質的に紙上カブリの無い良好な画像であり、5%を超えると紙上カブリが目立つ不鮮明な画像である。

a：5000枚プリント終了時に、紙上カブリ量2%以下
 b：3000枚プリント終了時に紙上カブリ量5%未満であり、5000枚プリント終了時に、紙上カブリ量5%以上
 c：1000枚プリント終了時に紙上カブリ量5%未満であり、3000枚プリント終了時に、紙上カブリ量5%以上
 d：500枚プリント終了時に紙上カブリ量5%未満であり、1000枚プリント終了時に、紙上カブリ量5%以上
 e：500枚プリント終了時に、紙上カブリ量5%以上

【0306】細線再現性
 細線再現性の評価は、図9に示すような線状の潜像画像を形成し、定着後の画像について評価を行った。

【0307】図9は、解像度600dpiにおける潜像部幅が4ドット(170μm)であり、非潜像部幅が10ドット(420μm)の潜像画像である。

【0308】上記線状の潜像画像を連続して1,000枚形成し、1,000枚目の定着画像を用い、画像部から無作為に5点を選び、5点の画像部幅の平均値と、潜像部幅(170μm)との差の絶対値で評価した。

a：0μm以上30μm以下
 b：30μm超60μm以下
 c：60μm超90μm以下
 d：90μm超

【0309】上記の評価を、印刷枚数が3000枚時、及び5000枚時の画像についても行った。

【0310】トナーの各種物性を表2に示し、評価結果を表4に示す。

【0311】実施例2
 実施例1で用いたシリカ微粉末(B-1)0.5重量部

に代えて、表面処理をしていないBET比表面積が81m²/gのシリカ微粉末(B-2)0.4重量部を用いることを除いては、実施例1と同様に表2に示す各種物性を有するシアントナー(2)を得、これを非磁性一成分系現像剤(2)とした。

【0312】この非磁性一成分系現像剤(2)を用いて実施例1と同様に評価を行った。

【0313】評価結果を表4に示す。

【0314】実施例3
 実施例1で用いたシリカ微粉末(A-1)1.0重量部及びシリカ微粉末(B-1)0.5重量部に代えて、シ

リコーンオイルで表面処理をしたBET比表面積が145m²/gのアルミナ微粉末(A-2)1.0重量部及びシリコーンオイルで表面処理をしたBET比表面積が70m²/gのシリカ微粉末(B-3)0.6重量部を用いることを除いては、実施例1と同様に表2に示す各種物性を有するシアントナー(3)を得、これを非磁性一成分系現像剤(3)とした。

【0315】この非磁性一成分系現像剤(3)を用いて実施例1と同様に評価を行った。

【0316】評価結果を表4に示す。

【0317】実施例4
 実施例1で用いたシリカ微粉末(B-1)0.5重量部に代えて、ヘキサメチルジシラン及びジメチルシリコーンオイルの順で表面処理をしたBET比表面積が73m²/gのシリカ微粉末(B-4)0.6重量部を用いることを除いては、実施例1と同様に表2に示す各種物性を有するシアントナー(4)を得、これを非磁性一成分系現像剤(4)とした。

【0318】この非磁性一成分系現像剤(4)を用いて実施例1と同様に評価を行った。

【0319】評価結果を表4に示す。

【0320】実施例5
 実施例1で用いたシリカ微粉末(A-1)1.0重量部及びシリカ微粉末(B-1)0.5重量部に代えて、表面処理をしていないBET比表面積が141m²/gのシリカ微粉末(A-3)0.8重量部及びヘキサメチルジシラン及びジメチルシリコーンオイルの順で表面処理をしたBET比表面積が60m²/gのシリカ微粉末(B-5)0.6重量部を用いることを除いては、実施例1と同様に表2に示す各種物性を有するシアントナー(5)を得、これを非磁性一成分系現像剤(5)とした。

【0321】この非磁性一成分系現像剤(5)を用いて実施例1と同様に評価を行った。

【0322】評価結果を表4に示す。

【0323】実施例6
 実施例1で用いたシリカ微粉末(B-1)0.5重量部に代えて、表面処理をしていないBET比表面積が86m²/gの酸化チタン微粉末(B-6)0.6重量部を用いることを除いては、実施例1と同様に表2に示す各種物性を有するシアントナー(6)を得、これを非磁性一成分系現像剤(6)とした。

【0324】この非磁性一成分系現像剤(6)を用いて実施例1と同様に評価を行った。

【0325】評価結果を表4に示す。

【0326】実施例7
 実施例1で用いたシリカ微粉末(A-1)1.0重量部及びシリカ微粉末(B-1)0.5重量部に代えて、シリカ微粉末(A-1)1.3重量部及びシリコーンオイル(モノマー)ステレン

(モノマー)ステレン

ルで表面処理したBET比表面積が60m²/gのシリカ微粉末(B-7)0.6重量部を用いることを除いては、実施例1と同様に表2に示す各種物性を有するシアントナー(7)を得、これを非磁性一成分系現像剤(7)とした。

【0327】この非磁性一成分系現像剤(7)を用いて実施例1と同様に評価を行った。

【0328】評価結果を表4に示す。

【0329】実施例8
 実施例1で用いたシリカ微粉末(A-1)1.0重量部及びシリカ微粉末(B-1)0.5重量部に代えて、シリカ微粉末(A-1)4.0重量部及びシリカ微粉末(B-1)0.5重量部を用いることを除いては、実施例1と同様に表2に示す各種物性を有するシアントナー(8)を得、これを非磁性一成分系現像剤(8)とした。

【0330】この非磁性一成分系現像剤(8)を用いて実施例1と同様に評価を行った。

【0331】評価結果を表4に示す。

【0332】実施例9
 実施例1で用いたシリカ微粉末(A-1)1.0重量部及びシリカ微粉末(B-1)0.5重量部に代えて、シリカ微粉末(A-1)0.7重量部及びシリカ微粉末(B-1)3.6重量部を用いることを除いては、実施例1と同様に表2に示す各種物性を有するシアントナー(9)を得、これを非磁性一成分系現像剤(9)とした。

【0333】この非磁性一成分系現像剤(9)を用いて実施例1と同様に評価を行った。

【0334】評価結果を表4に示す。

【0335】実施例10
 実施例1で用いたシリカ微粉末(A-1)1.0重量部及びシリカ微粉末(B-1)0.5重量部に代えて、シリカ微粉末(A-1)2.4重量部及びシリカ微粉末(B-1)1.7重量部を用いることを除いては、実施例1と同様に表2に示す各種物性を有するシアントナー(10)を得、これを非磁性一成分系現像剤(10)とした。

【0336】この非磁性一成分系現像剤(10)を用いて実施例1と同様に評価を行った。

【0337】評価結果を表4に示す。

【0338】実施例11
 イオン交換水700重量部に、0.1M-Na₃PO₄水溶液450重量部を投入し、50℃に加熱した後、TK式モミキサー(特殊機工業製)を用いて、10.00rpmにて攪拌した。これに1.0M-CaCl₂水溶液70重量部を徐々に添加し、リン酸カルシウムを含む水系凝体を得た。

175重量部

い粒子のみを採取できるように分級操作を繰り返すよう
に變更して粒度分布を調整したBET比表面積が2.2 m²/gのシリカ微粉末(B-9) 0.5重量部を用いる
【0382】評価結果を表4に示す。
【0383】
ことを除いては、実施例1と同様に表3に示す各種
物性を有するシアントナー(20)を得、これを非磁性
一成分系現像剤(20)とした。

トナー	粒度分布	トナー				トナー				トナー				トナー			
		トナー				トナー				トナー				トナー			
		平均粒径(μm)	最大粒径(μm)	最小粒径(μm)	標準偏差(μm)	平均粒径(μm)	最大粒径(μm)	最小粒径(μm)	標準偏差(μm)	平均粒径(μm)	最大粒径(μm)	最小粒径(μm)	標準偏差(μm)	平均粒径(μm)	最大粒径(μm)	最小粒径(μm)	標準偏差(μm)
7771-1	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-2	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-3	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-4	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-5	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-6	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-7	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-8	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-9	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-10	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-11	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-12	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-13	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-14	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-15	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-16	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-17	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-18	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-19	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-20	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1

【0384】

トナー	粒度分布	トナー				トナー				トナー				トナー			
		トナー				トナー				トナー				トナー			
		平均粒径(μm)	最大粒径(μm)	最小粒径(μm)	標準偏差(μm)	平均粒径(μm)	最大粒径(μm)	最小粒径(μm)	標準偏差(μm)	平均粒径(μm)	最大粒径(μm)	最小粒径(μm)	標準偏差(μm)	平均粒径(μm)	最大粒径(μm)	最小粒径(μm)	標準偏差(μm)
7771-1	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-2	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-3	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-4	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-5	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-6	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-7	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-8	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-9	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-10	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-11	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-12	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-13	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-14	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-15	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-16	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-17	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-18	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-19	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1
7771-20	0.970	5.1	8.8	2.4	1.2	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.1	1.1	1.1

【0385】

【表4】

トナーNo.	画像濃度				ベタ画像濃度安定性				解像再現性			
	初期				初期				初期			
	初期	1000	3000	5000	初期	1000	3000	5000	初期	1000	3000	5000
7771-1	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
7771-2	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
7771-3	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
7771-4	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
7771-5	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
7771-6	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
7771-7	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
7771-8	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
7771-9	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
7771-10	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
7771-11	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
7771-12	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
7771-13	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
7771-14	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
7771-15	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
7771-16	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
7771-17	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
7771-18	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
7771-19	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
7771-20	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50

【0386】実施例12

実施例1で用いたC. I. ビグメントブルー15:3に
加えて、C. I. ビグメントレッド12を11重量
部、C. I. ビグメントイエロー17を14重量部及び
カーボンブラックを10重量部それぞれ用いること
を除いては、実施例1と同様にマゼンタトナー粒子
(6)、イエロートナー粒子(7)及びブラックトナ
ー粒子(8)をそれぞれ製造した。
【0387】実施例1で用いたLBP-2030改機機
を用い、シアン現像剤4Cに実施例1で用いた非磁性一
成分系現像剤(1)を160g充填し、マゼンタ現像
剤4Mに上記の非磁性一成分系現像剤(21)を160g
充填し、イエロー現像剤4Yに上記の非磁性一成分系
現像剤(22)を160g充填し、ブラック現像剤4Bに
上記の非磁性一成分系現像剤(23)を160g充填
した。

【0388】画像形成は、以下の条件で行なった。

【0389】一次帯電条件：図1において図示しない
電源から帯電ローラー2に、-600Vの直流電圧を、
1150Hzの正弦波で振幅2kVppの交流電圧を重
畳させた帯電バイアス電圧を印加した。帯電ローラー2
に電圧を印加することにより、絶縁体の感光ドラム1に
対して放電により電荷を移動させて一様に帯電を行なっ

た。

【0390】画像形成条件：一様に帯電された感光
ドラム1上にレーザ光を照射露光し、静電潜像を形成し
た。露光された部分の表面電位は-200Vになるよう
にレーザ光強度を設定した。

【0391】イエロー、マゼンタ、シアン及びブラック
の色順で現像を行い、順次中間転写ドラム上に各色のト
ナー像を一次転写し、中間転写ドラム上に一次転写され
た4色の多重トナー像を感光ドラム上に一括して二次転写
し、この4色の多重トナー像を記録材に加えて定着してフ
ルカラー画像を形成した。

【0392】現像条件：図1中のイエロー現像剤4
Y、マゼンタ現像剤4M、シアン現像剤4C及びブラック
現像剤4Bのそれぞれに、図1中4Yのイエロー現
像剤に、-350Vの直流電圧と、2300Hzの正弦
波で振幅2kVppの交流電圧を重畳させたものを印加
せしめ、現像スリーブと感光ドラム1との間(間隙30
0μm)に交番電圧を形成し、現像スリーブ上のトナ
(トナー層厚170μm)を飛移させて現像を行った。

【0393】一次転写条件：現像剤4Yにより現像さ
れたトナー画像を中間転写体5に一次転写するために
は、アルミニウム製のドラム5aに印加する一次転写バ
イアス電圧を+100Vの直流電圧とした。現像剤4M

法を用いる画像装置の説明図である。

【図7】本発明のトナーを用いる二成分系現像方法を用いる画像装置の説明図である。

【図8】図1で示す画像形成装置のドラム状の中間転写体に代えてベルト状の中間転写体を用いた画像形成装置の説明図である。

【図9】精細部画像の表現性を評価するために用いたパターンを示す。

【図10】非球形無機微粉末(B)の粒子形状を示す模式図である。

【図11】本発明の画像形成装置をフタクシミリ装置のプリンターに適用した場合のプロック図である。

【符号の説明】

1 感光体ドラム (潜像担持体)

2 帯電ローラー

3 芯金 (中間転写体手段)

4 (4Y, 4M, 4C, 4Bk) 現像器

5 中間転写体

6 クリーニング機構

7 トレー

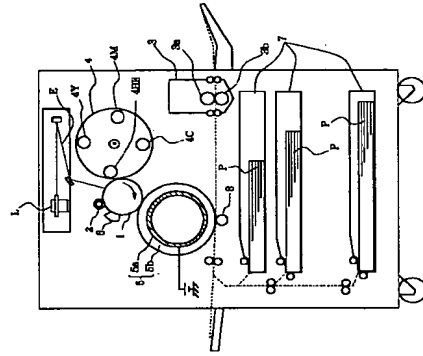
8 転写手段

9 定着器

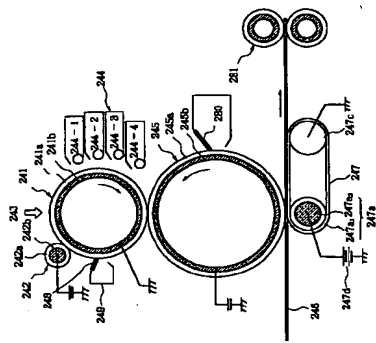
9a 定着ローラー

9b 加圧ローラー

【図1】



【図5】



2、244-3及び244-4に示す非磁性一成分系現像剤を用いる非磁性一成分系現像方式の現像装置170をそれぞれ用いたフルカラー画像形成装置を用い、実施例1で製造した非磁性一成分系現像剤(1)及び実施例12で製造した非磁性一成分系現像剤(2)1)、(2)及び(23)を用いてフルカラー画像の形成を行った。

【0401】現像器244-1の現像器には、非磁性一成分系現像剤(23)を充填し、現像器244-2に非磁性一成分系現像剤(21)を充填し、現像器244-3には、非磁性一成分系現像剤(1)を充填し、現像器244-4には、非磁性一成分系現像剤(22)を充填し、ブラック、マゼンダ、シアシアン及びイエローの色順で現像を行い、順次中間転写ドラム上に各色のトナー像を転写し、中間転写ドラム上に転写された4色の多重トナー像を転写材に一括転写し、転写材に加齢定着しフルカラー画像を形成した。

【0402】中間転写ドラム：帯電体：アルミニウム、弾性層：ステレン-ブタジエンゴム、厚さ5mm

一次帯電条件：直流成分：-600V、交流成分：2000Hz、振幅1.8kVpp

感光体に形成した静電潜像：-250V

現像バリエーション電圧：直流成分：-400V、交流成分：2000Hz、振幅1.8kVpp

感光体ドラムと現像スリートの距離：300μm

現像スリート上の現像剤層厚：170μm

一次転写条件：転写部24a：直流電圧+100V、転写部24b：直流電圧+150V、転写部24c：直流電圧+200V、転写部24d：直流電圧+250V

二次転写条件：直流電圧+2000V

【0403】その結果、15000枚の長期に渡る通紙によっても、定着画像の画像濃度、紙上カブリ抑制及び細線再現性に優れており、色調再現性に優れたフルカラー画像を安定して得ることができた。

【0404】

【発明の効果】本発明によれば、長期耐久においても現像剤が劣化することがなく画像濃度安定性、精細部再現性に優れ、カブリの生じない画像を得ることができる。

【図面の簡単な説明】

【図1】本発明のトナーを用いた他の画像形成方法を実施し得る画像形成装置の説明図である。

【図2】本発明のトナーを用いた他の画像形成方法を実施し得る画像形成装置の説明図である。

【図3】本発明のトナーを用いた他の画像形成方法を実施し得る画像形成装置の説明図である。

【図4】本発明のトナーを用いた他の画像形成方法を実施し得る画像形成装置の説明図である。

【図5】本発明のトナーを用いた他の画像形成方法を実施し得る画像形成装置の説明図である。

【図6】本発明のトナーを用いる非磁性一成分系現像方

により現像されたトナー画像を中間転写体5上に一次転写するためには、アルミニウム製のドラム5aに印加する一次転写バリエーション電圧を+200Vの直流電圧とした。

現像器4cにより現像されたトナー画像を中間転写体5上に一次転写するためには、アルミニウム製のドラム5aに印加する一次転写バリエーション電圧を+300Vの直流電圧とした。現像器4Bkにより現像されたトナー画像を中間転写体5上に一次転写するためには、アルミニウム製のドラム5aに印加する一次転写バリエーション電圧を+400Vとした。

【0394】二次転写条件：中間転写体5上に一次転写された4色のフルカラートナー画像を転写材Pに一括して二次転写するため、転写手段8に二次転写バリエーション電圧として+2000Vの直流電圧を印加した。

【0395】その結果、5000枚通紙によっても、定着画像の画像濃度、紙上カブリ抑制及び細線再現性がいずれも優れており、色調再現性に優れたフルカラー画像を安定して得ることができた。

【0396】実施例13

図2に示す画像形成装置の現像部17a、17b、17c及び17dに図6に示す非磁性一成分系現像剤を用いる非磁性一成分系現像方式の現像装置170をそれぞれ用いたフルカラー画像形成装置を用い、実施例12で製造した非磁性一成分系現像剤(1)及び実施例12で製造した非磁性一成分系現像剤(21)、(22)及び(23)を用いてフルカラー画像の形成を行った。

【0397】現像部17aの現像器には、非磁性一成分系現像剤(21)を充填し、現像部17bの現像器には、非磁性一成分系現像剤(1)を充填し、現像部17cの現像器には、非磁性一成分系現像剤(22)を充填し、現像部17dの現像器には、非磁性一成分系現像剤(23)を充填し、ブラック、シアシアン、マゼンダ及びイエローの色順で静電潜像の現像及び転写材としての転写材への転写を以下の条件で順次行って、転写材上に4色の多重トナー像を形成し、転写材に加齢定着してフルカラー画像を形成した。

【0398】感光体に形成した静電潜像：-150V

現像バリエーション電圧：直流成分：-300V、交流成分：2000Hz、振幅1.8kVpp

感光体ドラムと現像スリートの距離：300μm

現像スリート上の現像剤層厚：170μm

現像バリエーション電圧：転写部24a：+100V、転写部24b：+170V、転写部24c：+240V、転写部24d：+310V

【0399】その結果、20000枚の長期に渡る通紙によっても、定着画像の画像濃度、紙上カブリ抑制及び細線再現性に優れており、色調再現性に優れたフルカラー画像を安定して得ることができた。

【0400】実施例14

図5に示す画像形成装置の現像器244-1、244-2、244-3及び244-4に示す非磁性一成分系現像剤を用いる非磁性一成分系現像方式の現像装置を用い、実施例12で製造した非磁性一成分系現像剤(1)及び実施例12で製造した非磁性一成分系現像剤(21)、(22)及び(23)を用いてフルカラー画像の形成を行った。

【0401】

【発明の効果】本発明によれば、長期耐久においても現像剤が劣化することがなく画像濃度安定性、精細部再現性に優れ、カブリの生じない画像を得ることができる。

【図面の簡単な説明】

【図1】本発明のトナーを用いた他の画像形成方法を実施し得る画像形成装置の説明図である。

【図2】本発明のトナーを用いた他の画像形成方法を実施し得る画像形成装置の説明図である。

【図3】本発明のトナーを用いた他の画像形成方法を実施し得る画像形成装置の説明図である。

【図4】本発明のトナーを用いた他の画像形成方法を実施し得る画像形成装置の説明図である。

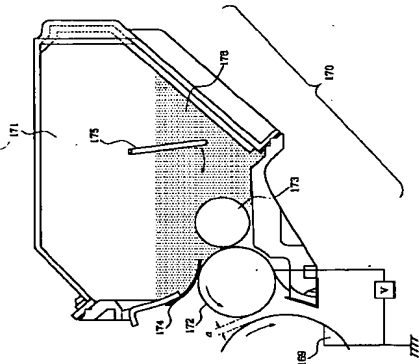
【図5】本発明のトナーを用いた他の画像形成方法を実施し得る画像形成装置の説明図である。

【図6】本発明のトナーを用いる非磁性一成分系現像方

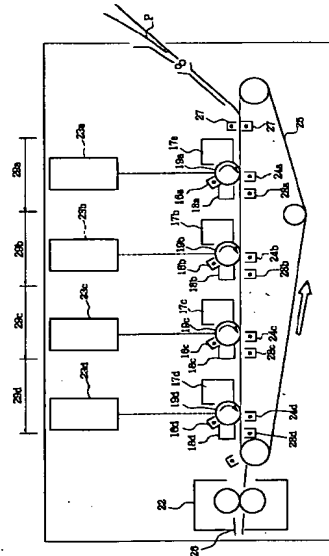
【図 10】



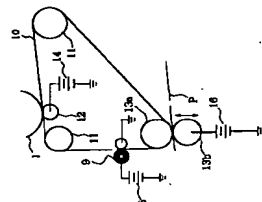
【図 6】



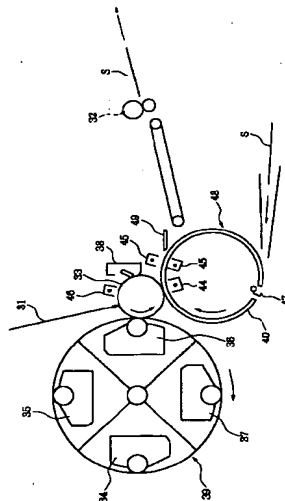
【図 2】



【図 8】



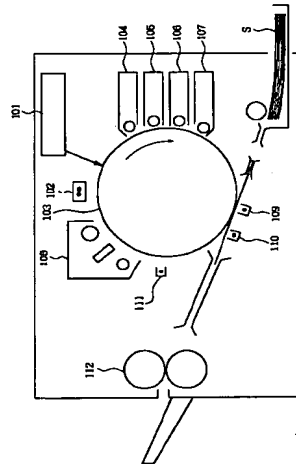
【図 3】



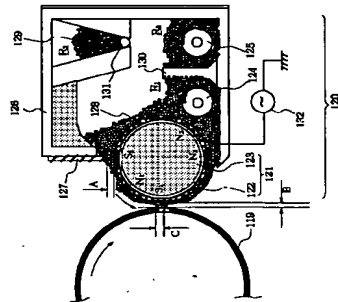
【図 9】



【図 4】



【図 7】



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